

SPECIAL SOUND AND AUDIO ISSUE

# RADIO & TELEVISION NEWS

NOVEMBER  
1949

RADIO-ELECTRONIC  
ENGINEERING  
EDITION

WMOR

SUPERSONIC TONE  
SELECTS RECEIVERS

Page 61

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In Radio and Television Tube Sales

# 1949 IS A G-E YEAR!



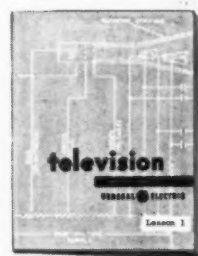
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# NEW



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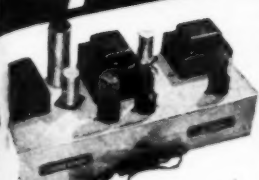
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UP code amplitude and frequency modulation circuits put voice, music, etc., on "electrical signal" you produce. You introduce, correct defects, learn how to get best performance.



**YOU MEASURE** current, voltage (AC, DC and RF), resistance and impedance in circuits with Electronic Multitester you build. Shows how basic transmitter circuits behave; needed to maintain station operation.



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"I am now Chief Engineer at Radio Station WAGC. Still using my N. R. I. texts as well references."—CHAS. W. STOKELY, Chattanooga, Tenn.

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"I am now Chief Engineer of Radio Station WQED, in New York City. I have been in the field for several years. I am now specializing in Marine Radio telephone installations and service."—MURRAY DICKSON, Paducah, Ky.

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COVER PHOTO. Jay Trompeter, announcer and engineer, in the control room at FM Station WMOR. On the right against the wall are two Magnecord tape recorders. (Kodachrome by Art Haug)

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**RADIO & TELEVISION NEWS**



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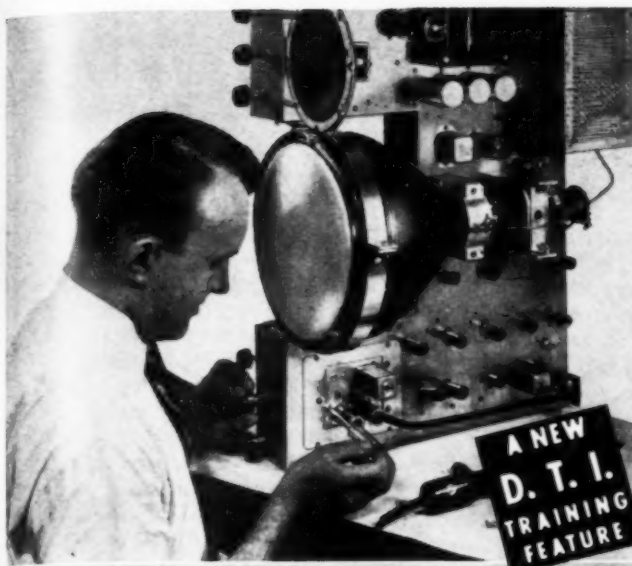
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## *For the* **RECORD.**

• BY THE EDITOR

**M**ANY years of experience in analyzing **RADIO & TELEVISION NEWS'** “reader interest” shows an almost universal preference for more and more articles on audio and sound. Many requests are received from radio technicians wanting to know how they can increase their earnings by renting and selling p.a. equipment. Others want to know how to take measurements and make frequency runs and over-all performance checks on amplifiers. Then there is the engineer who is always seeking fresh information on new circuits and techniques. Even the amateur has an interest in sound and is continuously searching for means of getting the best possible intelligence from his modulator or from the audio system in his receiver.

The student in sound may be one trying for only a limited amount of knowledge so he may go ahead and do experimental work with the construction of amplifiers and recording systems, or he may be aiming for a degree in audio engineering. We find, therefore, that there is no segment of radio, television, or electronics that has greater widespread interest than has audio and sound. Accordingly, and in reply to the many requests for up-to-the-minute material on all phases of this specialized subject, we are devoting the editorial contents of this month's issue to a discussion of the many facets of sound.

Special articles were assigned to our top writers, including John Goodell of *Minnesota Electronics*, who is considered one of the foremost authors on speaker systems in the country. Mr. Goodell gives an analysis of speaker enclosures, based on actual work done in conjunction with custom installations. Mr. Glen Southworth, who has been writing for **RADIO & TELEVISION NEWS** for many years, tells how to evaluate distortion in audio amplifiers. Hams will be especially interested in the c.w. filter described by Commander Countryman, W3HH, which is designed to reject interfering signals.

We have received many requests for a simple test analyzer that would be capable of checking distortion in amplifiers when used in conjunction with an audio oscillator and an oscilloscope. Michael Wolfe, in his article on Page 44, tells how this is done.

If you are looking for a good-quality amplifier with a full-range tone control and simplified dynamic noise suppressor, don't miss reading Charles Mayeda's “Wide-Range Phono Ampli-

fier” on Page 46. Intercoms seem to be high on the list of requested articles. R. G. Finkbeiner, W8AQK, gives answer to these requests in his article describing the construction of an intercom for the home or office. No matter what a reader's interest may be in audio and sound, the chances are that he will find something of definite interest in these or in many of the other articles appearing in this special November issue.

We commissioned Dave Fidelman, one of our top writers, to examine the audio field and to prepare a complete analysis of test instruments. Here for the first time is a complete, concise presentation of equipment suitable for various tests, including frequency response, noise level, voltage current or power, harmonic distortion, intermodulation distortion, transient response, phase response, and wow and flutter. Mr. Fidelman breaks his charts into specific categories, such as signal generating instruments, instruments for measurement and observation of electrical signals, instruments for measurement of sound, instruments for characteristics of audio signals, multiple instruments, and accessory units. The preparation of so extensive an assignment as this was not an easy task. Mr. Fidelman certainly came through with flying colors, and we are sure you will agree.

In this issue, we had planned to bring you a similar breakdown of disc, wire, and tape recorders, together with complete specifications; however, the inclusion of this material would have necessitated the elimination of the analysis on audio test instruments. Accordingly, it will be prepared for a future issue devoted largely to recording and playback systems.

Even our front cover this month was chosen especially to illustrate the subject of sound. You will enjoy reading the article on Page 61, which describes a unique application of sound employed by Station WMOR in the Chicago area. Conceived and operated by some ex-GIs, the story of WMOR is indeed a story of success. This station has a reputation for maintaining a high degree of audio fidelity.

We sincerely hope all our readers will enjoy this special content issue, and would appreciate receiving reactions and comments. If you would like in the future to have more issues similarly devoted to specialized subjects, it will be our pleasure to serve you. . . . .O. R.

**RADIO & TELEVISION NEWS**



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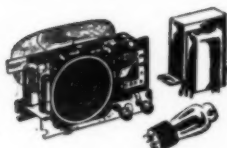
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### TYPE 16GP4

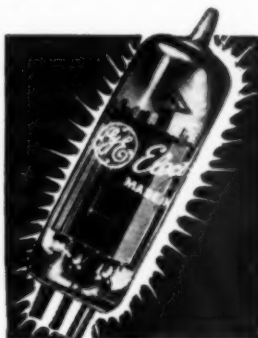
16-inch metal picture tube, with wide-angle (70-degree) sweep, and high-contrast-glass face. Designed for modern receivers where size of the cabinet is restricted, yet the picture must be large, clear, and sharp. . . . Tube is less than 18 inches long; its weight is approximately half that of an all-glass type. . . . Generous picture area is 163 sq. inches when the entire tube face is scanned; 132.5 sq. inches when standard raster of 3-by-4 aspect is employed. . . . Special high-contrast-glass face helps produce a clear image with superior definition.



# TELEVISION! GENERAL ELECTRIC TUBES!

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Progress shows, for example, in every characteristic of G.E.'s new 16-inch wide-angle picture tube. Because of its comparatively short length, you can design a receiver about Type 16GP4 that will fit conveniently into the average small living-room. At the same time, the picture area is large, giving excellent visibility for a good-sized group of guests. The face of the tube is a special new dark-tone glass providing high contrast . . . images show more clearly,



G-E receiving tubes of advanced design spell progress and economy. The new 6BN6, a miniature gated-beam tube, functions as a limiter, discriminator, and audio-amplifier in TV and FM receivers, thereby replacing 3 tubes and associated components.

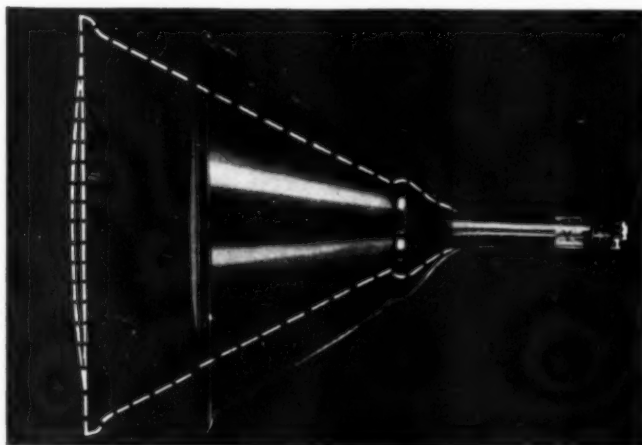
with sharper definition.

Other G-E picture tubes—Types 8AP4, 10BP4, 10FP4, 12KP4 and 12LP4—share in the advancements being recorded by General Electric's continuous research in television. And a full line of G-E receiving-type tubes is available, including such outstanding new designs for television use as the 6AB4, 6BN6, 12AT7, 12AU7, and 12AY7.

Choose General Electric tubes to make sure the product you design, build, and sell is in the forefront competitively! Experienced G-E tube engineers will be glad to work with you in selecting the right types for your circuit. Wire or write today to *General Electric Company, Electronics Department, Schenectady 5, New York.*

## SHORTER—MAKES POSSIBLE A MORE COMPACT TV RECEIVER

Why Type 16GP4 picture tube is nearly 5 inches shorter than the standard 16AP4 16-inch type, is shown here. A sweep angle of 70 degrees for the 16GP4 against 53 degrees for the 16AP4 (portrayed in dotted lines) results in a flatter conical shell. This reduces the over-all length of the tube to 17 $\frac{1}{8}$  inches, compared with 22 $\frac{3}{8}$  inches for the 16AP4. Receivers using the new tube can be shorter and less bulky, consequently are more acceptable in the home.



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look like this* →



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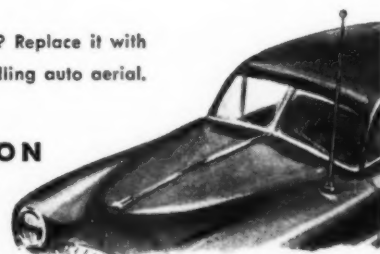


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**RADIO & TELEVISION NEWS**





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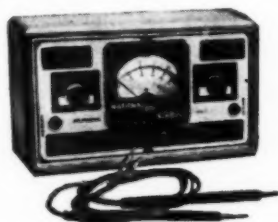
**Both Resident and Home Study  
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You receive special laboratory experiment lessons to show you how to build with your own hands various experimental units such as those shown at left, and how to conduct many tests.

**YOU  
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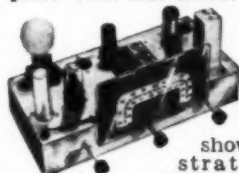
You receive complete standard equipment, including latest type High-Mu Tubes, for building various experimental and test units. You progress step by step until you build a complete Superheterodyne Receiver. It is yours to use and keep.



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**SIGNAL  
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You construct the Transistron Signal Generator shown here, demonstrating Transistron principles in both R.F. and A.F. stages. You study negative type oscillators at firsthand.



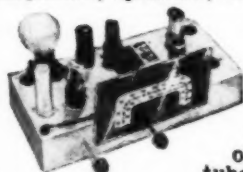
**AUDIO OSCILLATOR:**

An electronic device, which produces audio-frequency signals for modulating R.F. (radio frequency) carrier waves, testing A.F. (audio frequency) amplifiers, speakers, etc.



**T.R.F.  
RECEIVER**

You build several T.R.F. Receivers, one of which, a 4-tube set, is shown here. You learn construction, alignment, make receiver tests, and do trouble shooting.



You will find all lessons easy to understand because they are illustrated throughout with clear diagrams and step-by-step examples that you work out yourself. Every piece of the equipment and complete lesson material we send you is yours to keep and enjoy, including the multitester, experimental equipment, all parts of the Superheterodyne, tube manual, radio dictionary, and complete, modern Television texts. All parts are standard equipment.

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### HAND OR DESK MICROPHONE

(BA-116)



Rugged dependability and uniform frequency response. Unbeaten in its price range for PA, home, institutional and industrial use. Use in hand or on desk without need of stand. But also equipped for use with standard  $\frac{3}{8}$ " 27 thread stand. Brown metallic finish, 8' cable. List, \$14.75.

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Miniature contact-type microphone with unusually wide frequency response.  $\frac{7}{8}$ " x  $\frac{3}{4}$ " x  $\frac{5}{8}$ ". Output volume from .05 to .1 volt or higher. Complete with mounting clamp and 25' cable. List, \$19.50.



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A beautiful new microphone for applications that require natural reproduction of both music and voices. Uses an advanced development of the "Acoustical" cartridge pioneered by Brush. Pickup pattern non-directional in the horizontal plane. Essentially flat frequency response from 40 to 10,000 cps. Designed for use with  $\frac{3}{8}$ " 27 thread stand. Finished in maroon plastic and brushed chromium . . . . . List, \$22.50.

### GENERAL PURPOSE MICROPHONE (BA-106)



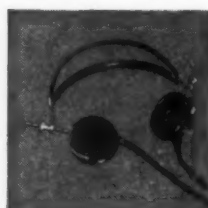
Using the exclusive "Acoustical" cartridge. Vibration, shock, low frequency wind noise or humidity do not affect the high fidelity. Excellent for general use. Output level Minus 50 db. below 1 volt/bar . . . . List, \$19.75.

### LAPEL MIKE (BL-2)

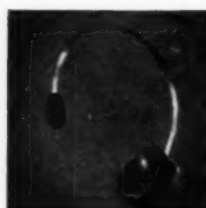
Virtually flat response. Small and rugged. Can be used as hand or instrument mike, as well as lapel.  $1\frac{1}{2}$ " x  $2\frac{1}{4}$ ". Complete with 25' cable. List . . . . . \$25.00.



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"BA-303" Hushatone \$9.75

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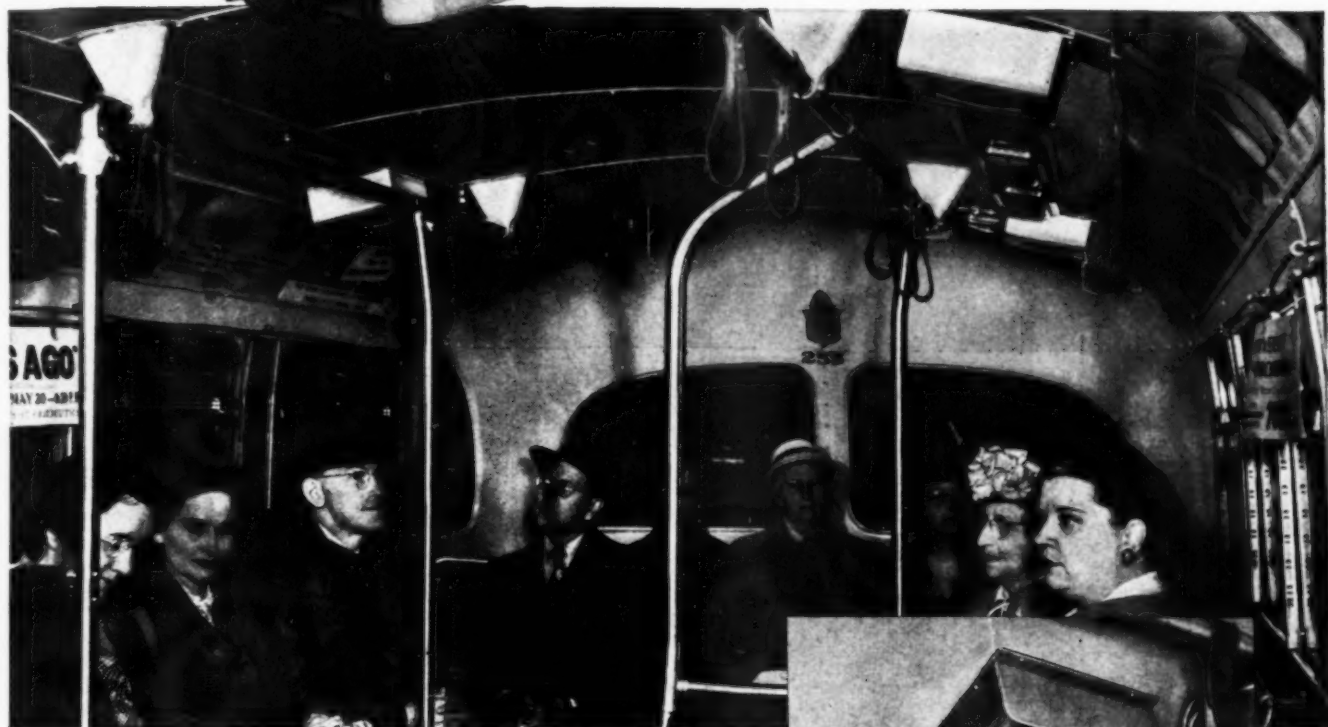
Brush products are distributed all over U. S. A. If your own radio parts jobber does not have it, write to us and we will send you name of nearest jobber.

**THE BRUSH DEVELOPMENT COMPANY**  
3405 Perkins Avenue • Cleveland 14, Ohio



**FM RADIO ON DULUTH-SUPERIOR BUSES  
MADE POSSIBLE THROUGH**

**LINK EQUIPMENT...  
SYLVANIA TUBES!**



In Duluth, Minnesota, passengers on Duluth-Superior Transit Co. buses listen to radio entertainment, weather forecasts and local where-to-buy-it information as they ride. Link Radio equipment with Sylvania Radio Tubes takes on the rugged broadcasting job.

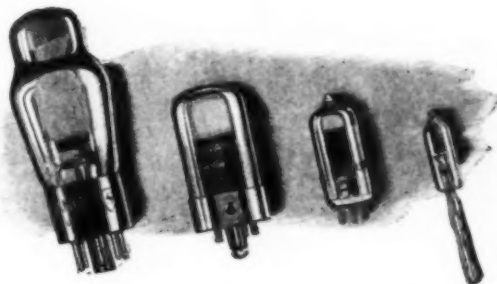
The success of transitcasting was assured with the development by Link Radio of an ultra-sensitive, fixed-frequency, crystal-controlled mobile FM receiver with high-fidelity characteristics. 35 of these receivers—complete with Sylvania Radio Tubes—have been riding through ice-furrowed streets, extremes of noise and temperature, and up and down steep hills in Duluth for over a year . . . and maintenance has been so low that one man can easily service all of them!

Sylvania tubes have a long record of superlative performance under rugged conditions—having been in use in autos, trains, and aircraft from coast to coast. For full details about the entire line address Radio Tube Division, Advertising Dept. E-2912, Emporium, Pa.

**SYLVANIA  
ELECTRIC**



Close-up of Link speaker. These units are attached to ceiling of bus at regular intervals for even distribution of sound.



The Sylvania line of high quality tubes includes every variety for a multitude of applications—from the standard glass tubes to the tiny subminiatures.

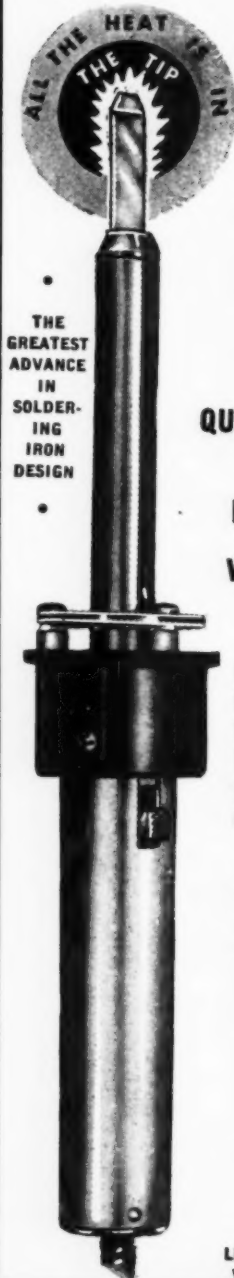


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# Spot Radio News

★ Presenting latest information on the Radio Industry.

By **RADIO & TELEVISION NEWS'**

WASHINGTON EDITOR

**AN HISTORIC PATTERN** of TV's future began to unfold in Washington during the early fall days, when the much-heralded allocation hearings were finally called to order in the Commission's session hall in the Department of Commerce building. Striking testimony on the possibilities of video in monochrome and in color, on the present bands and in the ultra-highs, offered by rounds of specialists during the initial days of the meeting, which, incidentally, was expected to last for many weeks and possibly months, disclosed that significant strides had been made in the laboratories of the country.

The accent appeared to be on color, with RMA, JTAC (Joint Technical Advisory Committee), CBS, and RCA the featured performers.

Preceded by an intriguing bit of correspondence with Senator Edward C. Johnson, chairman of the Senate Committee on Interstate and Foreign Commerce, and FCC Commissioners Robert F. Jones and Paul A. Walker, the CBS story teemed with drama. The letter writing was sparked by Senator Johnson, who, after attending a demonstration of color television staged by Smith, Kline, and French at the Armory in Washington, notified CBS that the test was . . . "a magnificent and utterly convincing proof that color TV is here now, and that all that is necessary for it to sweep the nation is for the FCC to remove the roadblock and promulgate standards for its operation. . . . However, the reluctance to show the FCC the facts by those who know most about color and who can most effectively demonstrate its development disturbs me." Within a day, Frank Stanton, CBS prexy, replied to the Senator, stating that CBS is doing . . . "everything we reasonably can to make color television generally available at the earliest possible time."

Several days later, FCC Commissioner Jones fired a critical letter to CBS stating that . . . "Your zeal appears to have diminished in connection with the hearings merely because it has been instituted on the Commission's motion." The Commissioner went on to explain that CBS had failed to provide other than handmade equipment for tests. Said the FCC official: "Your action in the matter might well lead one to the conclusion

that, while your company is anxious to transmit color TV, it is reluctant to permit others to operate color video receivers to appraise what you have transmitted. We must know whether laymen can operate the sets and can derive this only from experience of laymen operating the sets under as many diverse conditions as are common in black and white."

A seething reply from CBS Prexy Stanton in the form of an eight-page letter reported that . . . "No manufacturer would go into large-scale production of color converters and receivers unless a green light had first been given by the Commission. (By production was meant, of course, production in the accepted sense) . . . The production of quantities (25 to 100 or 100 to 1000) can be accomplished as a practical matter only through what amounts to hand fabrication with extremely high unit costs. . . . Thus, while the \$75 figure per converter (cited in earlier conversations with the Commissioner) approximates the cost on a mass-production basis, the unit cost of handmade models would be many times that figure. . . . The complex process of translating a laboratory model into a production design, from which production in quantity is possible, is not something that can be done overnight."

Then, referring to the Senator Johnson letter which implied that CBS was not cooperative, Stanton offered a review of what the broadcasting system had done with color since the summer of last year when they developed a 6 mc. color system. In the fall of '48, the system was demonstrated before the Commission in New York, with converted receivers used to pick up both color and black and white transmissions. And, according to Stanton, between December and May of this year, CBS had designed and constructed color TV equipment for demonstration of surgical and medical procedures under a contract with Smith, Kline, and French Laboratories. Shortly after, a color installation was made at the University of Pennsylvania Medical School, Stanton revealed, and on August 2, daily 6 mc. color transmissions were begun over WCBS-TV.

Continuing with his recording of CBS color work, Stanton cited that engineers had constructed and oper-

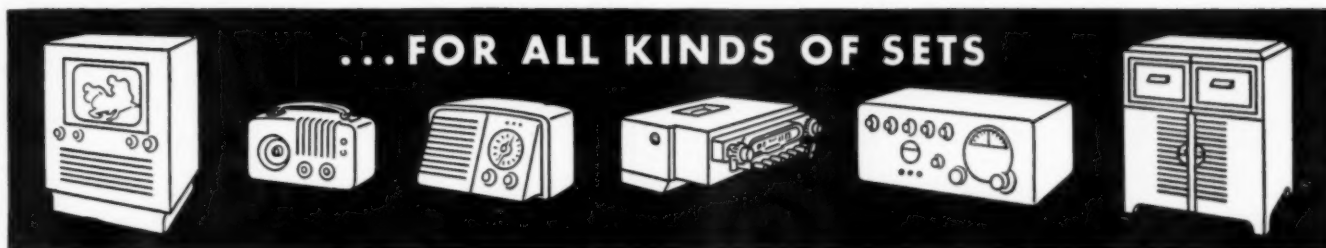
**RADIO & TELEVISION NEWS**





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**...OF ALL KINDS OF TUBES**



**...FOR ALL KINDS OF SETS**



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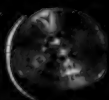


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NEWS

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New MERIT CATALOG No. 4911 is now ready. Shows all TV Replacements in regular line. Write for your copy. All catalog items in stock.

### POWER TRANSFORMERS

Type No.	List Price	H. V. Secondary Rectifier	D. C. Volts	M. A. Volts	Amp.	Fil. Volts	Wdgs. Amp.	Mtg. Center
P-3061	\$25.00	362-362	295	5	6	6.3	5	3 1/2 x 4 1/4
P-3063	\$20.00	360-360	250	5	3	6.3	2	3 1/2 x 4 1/4
RCA Repl.						6.3	2	

### Dimensions

Type No.	H	W	D	Mtg. Type
P-3061	6 1/2	3 7/8	4 7/8	C
P-3063	5 1/2	3 7/8	4 7/8	C

### VERTICAL OUTPUT TRANSFORMER

Type No.	List Price	Turns Ratio	Pri. to Sec.	Mtg. Centers	Mtg. Type
A-3035	\$5.25	10:1		1 1/2 x 2	EV

### Dimensions

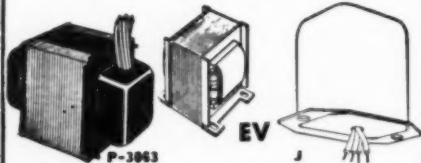
H	W	D
3 1/2	2 1/4	2 1/4

### VERTICAL BLOCKING OSCILLATOR TRANSFORMER

Type No.	List Price	Turns Ratio	Pri. to Sec.	Mtg. Centers	Mtg. Type
C-4000	\$2.75	1:4.2		1 1/2	J

### Dimensions

H	W	D
1 3/4	2 3/8	1 1/2



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ated an all-electronic receiver for the sequential system, employing one picture tube; developed new color primaries permitting use of standard picture tubes for reproduction; developed methods for converting standard receivers for black and white pickup of color signals or the sequential signals in color; used standard TV transmitters for sequential color sending; and cooperated with British engineers in the construction of a CBS-type color system for use in Great Britain.

In the letter to Commissioner Walker, Stanton declared that medical and surgical TV demonstrations are now being conducted and will continue until June of 1950. The reply also disclosed that arrangements had been completed with WOIC in Washington for the transmission of color signals as soon as the hearings began, for pickup over thirty receivers. Twenty-five were wired to pick up color signals in color, color signals in black and white, and black and white signals in monochrome, while the remaining five were used only for color pickup.

In a pre-hearing commentary on the factors to be judged in considering any color system, CBS said that electrical and economic compatibility with black and white methods were prime items.

Although no heated exchange of letters preceded the RCA appearance, their report for the record was quite exciting, too, disclosing a new all-electronic, wideband, simultaneous method of transmission of color, featuring the use of the present 6 mc. band, 525 lines, sixty fields-per-second, fifteen color pictures per second, and time-multiplex transmission. This system has been identified as a dot-sequential method with line and picture-dot interlace.

Describing the system, E. W. Engstrom, vice president in charge of research of the RCA lab division, said that the studio equipment provides three signals, one for each of the primary colors (green, red, and blue). Each color signal is sampled for a very short time,  $3.8 \times 10^{-6}$  times per second for each color. The three color signals from the camera are combined in an electronic adder and are then passed through a bandpass filter. The output of this filter contains frequencies between two and four megacycles, with contributions from each of the three color channels. The signal resulting from the addition of these three signals, identified as the sampler output, mixed high, and synchronizing pulses, are fed to a low-pass filter which cuts off at four megacycles. The signal from this filter is then applied to the modulator of a conventional transmitter.

Analyzing the electronic sampler, Engstrom said that the green is sampled every .263 microsecond (.263 =  $1/3.8$ ). At a time .0877 microsecond after a green sample, a sample is taken of the red signal. This time delay is one-third of the time between successive green samples. Red samples continue to be taken .263 micro-

second apart. Blue samples are taken at the same rate and follow the red samples by a time of .0877 microsecond. The composite output of the sampler consists of a superposition of the green, red, and blue trains of pulses or samples.

Commenting on the scanning sequence used by RCA, Engstrom declared that the odd lines are scanned during the first field, but dots of the same primary color are separated by spaces. The even lines are scanned during the second field, again with spaces between like color dots. During the third field, the odd lines are again scanned, but with the color dots displaced so that the spaces are filled. The even lines are scanned during the fourth field, with the color dots displaced to fill in the spaces left during the second field scanning. Four scanning fields are required to completely cover the picture area, with all spaces filled with, say, green dots. Simultaneously, the area is being covered with red and blue dots. Since there are sixty fields per second, it may be said that there are fifteen complete color pictures per second. The effective field rate for the large-area flicker is sixty per second, the same as for current black and white receivers. Engstrom said that at viewing distances such that the picture-line structure is not resolved, the effect of small-area flicker due to line interlace and picture-dot interlace is not visible.

A regular schedule of color transmissions over WNBW was also set up by RCA, with six receivers in operation. Explaining the tests in a letter to FCC Commissioner Walker, Dr. C. B. Jolliffe, executive vice-president in charge of the RCA labs, said that "... receivers will be placed in typical locations and used under home conditions."

Both CBS and RCA scheduled special color demonstrations of their systems for the FCC, inviting members of the industry, and will present standards and operational data based on these and subsequent tests for the record during the hearings.

Color systems using other types of scanning were also proposed at the Washington hearings. One method, developed by Color Television of San Francisco, called a line-sequential approach, featured successively-traced image lines that appear on the screen in different colors. According to George E. Sleeper, chief engineer of the coast company, a raster is traced in each of three colors (red, green, blue) on the picture tube in a selected sequence.

Leon Rubenstein of New York City offered still another type of color system, wherein a special type of screen was used to provide color. The screen was described as consisting of microscopic prisms which separate the reds, greens, and blues from the light.

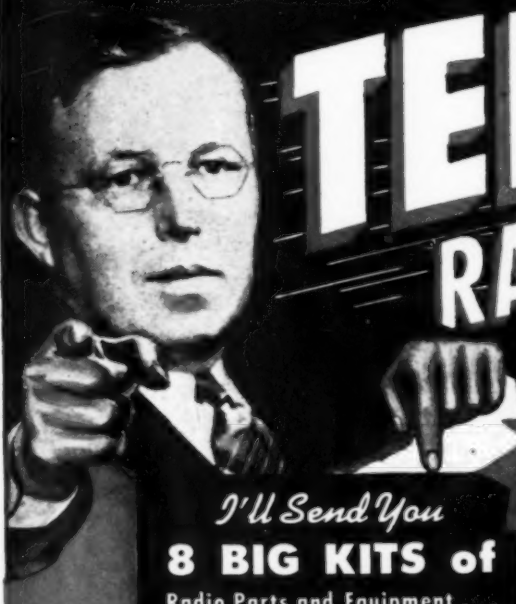
Although the period for official witness-stand comments on the proposals was, at this writing, weeks away, there were volumes of off-the-record opinion.

(Continued on page 163)

**RADIO & TELEVISION NEWS**



# YOU Need My PRACTICAL Training to Make Money in TELEVISION RADIO and ELECTRONICS!



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If you want to get into Radio-Television and Electronics . . . you owe it to yourself to get the facts about my training. I have trained hundreds of men to become outstanding service technicians—and I'm ready to do the same for you. Whether your goal is a fine paying job in one of Radio's many branches—or a successful Radio and Television business of your own—you need the kind of training I offer! My training is practical and down to earth. **YOU NEED NO PREVIOUS EXPERIENCE.** You'll be astonished at your rapid progress. I start you with basic fundamentals and give you plenty of practical shop-bench training with many kits of parts I send you. This is the training that sticks with you and makes money for you on the job!

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Soon after you start training I send you my famous **BUSINESS BUILDERS** that show you how to make money in spare time doing interesting Radio jobs. Look at the useful and valuable equipment you get while training with me (illustrated at left)—I send you these 8 big kits of Radio parts and equipment and help you build step-by-step a powerful 6-tube superhet radio, a 16-range test meter, plus other mighty, useful equipment for Radio and Television servicing. You will perform over 175 fascinating experiments while training. You will learn about Television—so that you will be qualified to step into this fast growing, profitable field. I also send you many valuable service manuals, diagrams and my book telling exactly how to set up your own Television and Radio shop. *I want you to learn all about my training—and that is why I urge you to clip and mail the coupon below for my two big FREE Radio books. I employ no salesmen—and nobody will call on you. The important thing is to act now and get the facts.*



## HAVE A BUSINESS OF YOUR OWN

A profitable Radio and Television Service Shop may be started with little capital. I will show you how to get started and how to build your small business. At left is pictured one of my graduates, Mr. Merrit C. Sperry of Fairmont, Minnesota in his own shop. The way is also open for you to build a good **SERVICE BUSINESS FOR YOURSELF.**

## RADIO AND TELEVISION INDUSTRY BOOMING

You couldn't pick a better time to get into Radio-Television and Electronics. New Television stations are going on the air to serve every major city—hundreds of new AM and FM Radio broadcasting stations are also on the air to serve practically every community in America. All this creates new and bigger opportunities for the trained man who knows Radio-Television and Electronics. Good Radio and Television service men are needed NOW!

## VETERANS

**THIS TRAINING  
AVAILABLE  
TO YOU UNDER  
THE G. I. BILL**



## ALL KITS ARE YOURS TO KEEP

Each of the hundreds of Radio parts and other items I send my students is theirs "for keeps." You may use this equipment in your Radio and Television service work and save many dollars by not having to buy expensive "ready-made" test equipment. Each of my 8 kits will help you advance and learn important steps in Radio and Television servicing.



**CALVIN SKINNER** of New Orleans, La. tells us he makes \$5 to \$10 in spare time repairing radios. He is now also working with his own Television set.



**LOREN D. SAUCIER** of Coloma, Mich. reports that my training has made it possible for him to repair large numbers of Radio and Television receivers.

My Training Includes:

**Radio Servicing  
Television  
FM Frequency  
Modulation  
Public Address  
and High  
Frequency  
Applications**



These Two Big  
Radio Books **FREE!**

Just mail coupon for a FREE sample Sprayberry Lesson and my big FREE book, "How To Make Money In Radio-Television and Electronics." Learn why my really practical training is best of all for you. Discover what's ahead for you in the fast moving Radio-Television and Electronics industry. No obligation. Don't delay—the future is too important to you. Mail the coupon now—and count on me for fast action.

## RUSH COUPON Today!

**SPRAYBERRY ACADEMY of RADIO, Dept. 25-C  
111 North Canal St., Chicago 6, Ill.**

Please rush my FREE copies of "How To Make Money In Radio-Television and Electronics" and "How To Read Radio Diagrams and Symbols."

Name.....Age.....

Address.....

City.....State.....

( ) Check here if you are a Veteran.

**SPRAYBERRY ACADEMY OF RADIO**  
111 N. CANAL, DEPT. 25-C, CHICAGO 6, ILL.





#### "LITTLE DEVIL" RESISTORS

For quick, easy identification, resistance and wattage are clearly marked on every one of these tiny, rugged insulated composition resistors. In three sizes — 1/2, 1, and 2-watt and all RMA resistances. Tolerance  $\pm 5$  and  $\pm 10\%$ .



#### R. F. PLATE CHOKES

"Frequency-rated" for easy selection and top performance. Single-layer wound on low power factor steatite or molded plastic cores. Wire is held rigidly in place, insulated, and protected by a moisture-proof coating. Seven stock sizes from 3 to 520 mc. Two units rated 600 ma; all others 1000 ma.



#### "BROWN DEVIL" RESISTORS

Wire-wound, vitreous-enameled Brown Devils provide utmost dependability in a size small enough to fit most installations. Easily mounted by 1 1/2" tinned wire leads. Three sizes: 5, 10, and 20 watts. Tolerance  $\pm 10\%$ .



*Write  
for your copy  
of Ohmite  
Catalog  
No. 21*

#### CLOSE CONTROL RHEOSTATS

Available in 10 sizes from 25 to 1000 watts, Ohmite rheostats can be relied on for close control and long life. Ceramic and metal construction. Windings are locked in place by vitreous enamel, and the metal-graphite brush provides unsurpassed smoothness of action.



# IT'S OHMITE FOR DEPENDABILITY



#### MOLDED COMPOSITION POTENTIOMETER

It's quiet! This Type AB Potentiometer has a resistance unit that's solid-molded. As a result, the noise level often becomes less with use. Has a 2-watt rating, good safety factor.

#### "LITTLE DEVIL" RESISTOR ASSORTMENT

Packed in this attractive, all-plastic cabinet are 125 carefully selected "Little Devils" (either 1/2 or 1 watt) in the 40 values you use most often. The assortment costs you only the regular price of the resistors, *nothing* extra for cabinet.



**OHMITE MANUFACTURING CO.**  
4883 Flournoy St., Chicago 44, Illinois



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# OHMITE

Reg. U. S. Pat. Off.

RHEOSTATS • RESISTORS • TAP SWITCHES • CHOKES • ATTENUATORS



# COMPLETE TRAINING

**FOR BETTER JOBS  
in Radio-Electronics**

## Ghirardi's BIG-3

### RADIO SERVICING LIBRARY

Here are three world-famous books so thoroughly covering radio theory, troubleshooting and servicing methods; so clearly explaining every phase of the work that, with a minimum of time, you'll soon be able to handle repairs and installations on any type of Radio-Electronic equipment. And that means you'll train quickly to qualify for better jobs, bigger pay checks and greater efficiency! You couldn't get a finer, more complete or easier-to-understand training course AT ANY PRICE. Remember! These are the same Ghirardi books that were more widely used for wartime training than any other books or courses of their type!

#### NEW LOW PRICE FOR THE COMPLETE SET

Bought singly, the books in this fact-packed library would cost you \$15. Under this special offer, you save \$1 if you buy all 3! No waiting for monthly lessons. You learn fast—and you learn right!

Let A. A. Ghirardi train you for radio-electronics—AT ABSOLUTE MINIMUM COST. Starting with the fundamentals of basic electricity, these 3 big books take you through the efficient radio testing, adjusting and repair procedures that mean time saving and more profitable work. Hundreds of working facts on tubes, color codes, transformers, resistors, capacitors, record changers, other components and more than 4,000 sets by over 200 manufacturers help you solve job snags in record time. You'll train fast and easily to repair ANY RADIO-ELECTRONIC EQUIPMENT EVER MADE better, faster and more profitably!

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**Complete Professional Training in Test, Instruments,  
Troubleshooting, Repair**

Ghirardi's 1300-page MODERN RADIO SERVICING is more widely used than any other book of its type—because it makes every phase of professional Radio-Electronic servicing so easy to learn. Once you've studied the basic fundamentals as outlined in Ghirardi's RADIO PHYSICS COURSE (No. 1) this big book teaches you to work by the modern, professional service methods that command the highest pay. Explains service instruments and when, where and just why to use each type. Tells how to trouble-shoot, analyze circuits, test circuits, test individual components and make all kinds of repairs, adjustments and installations. Includes complete facts and data on starting a successful service business of your own. 706 illustrations. Price \$5 if bought separately—but see special offer on all 3 Ghirardi books.

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**Complete Basic Training for Beginners**

No matter what part of Radio-Electronics-Television work you plan to enter, a knowledge of basic fundamentals is essential. Ghirardi's famous RADIO PHYSICS COURSE gives exactly the training you need—at a price you can afford to pay. Moreover, it makes even the most difficult subjects amazingly easy to understand. If broken into "course" form and sent to you as monthly lessons, you'd regard it as a bargain at \$50 or more. Instead you buy it for only \$5 and learn as fast as spare reading time permits. Many have completed this complete, basic training in a few weeks! 972 pages; 508 clear illustrations; 856 self-test review questions that make study easy. Price \$5 if bought singly.

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**Cuts Service Time in Half on 4 Jobs Out of 5**

This is the most recent of the 3 big Ghirardi books—and the handiest of all for the man who knows his way around in radio servicing. Just refer to RADIO TROUBLESHOOTER'S HANDBOOK for specific data on the radio you want to repair. It covers common troubles, their symptoms and complete repair methods for over 4,800 receivers by 202 leading set manufacturers. It eliminates useless testing, saves time on literally hundreds of jobs. Over 300 additional pages contain tube data, charts, etc. to help you work faster, better, more profitably on any radio ever made. Contains 744 manual-size pages. Weighs almost 4 lbs. Only \$5. Use coupon. See money-saving offer on all 3 Ghirardi books!

November, 1949





## UNDER SEVERE CONDITIONS

Three years ago Sangamo successfully pioneered the FIRST molded tubular capacitor. The experience gained in these three years is now applied by new effective manufacturing methods, and proven by special exhaustive tests which invariably exceed the requirements of actual service conditions. Thus, the Type 30 you purchase today offers positive promise of exceptional long life under severe conditions.

### **85° C Performance:**

Excellent. Trouble-free long-life operation in spite of the high temperatures encountered in auto radios, television receivers, or any other application where high temperatures cause trouble.

### **Humidity Resistance:**

Excellent. Results show insulation resistance practically unchanged under severe conditions of humidity.

### **Immersion Resistance:**

Excellent. Far surpasses any existing specification requirements. Insulation resistance not impaired.

### **Exposure Resistance:**

Excellent. Accelerated exposure test comparable to prolonged field exposure, but more severe, results in no change in performance ability.

### **Mechanical Strength:**

Excellent. Leads resist breaking or pulling out, even when handling is extremely rough.

Remember this about Sangamo Type 30 Tubulars: They are molded at low pressure. This means their elements are undamaged in fabrication. It also means longer life, greater dependability, and the absence of "hot spots." A trial of Sangamo Molded Tubulars will convince you!

*Your Assurance of*



*Dependable Performance*

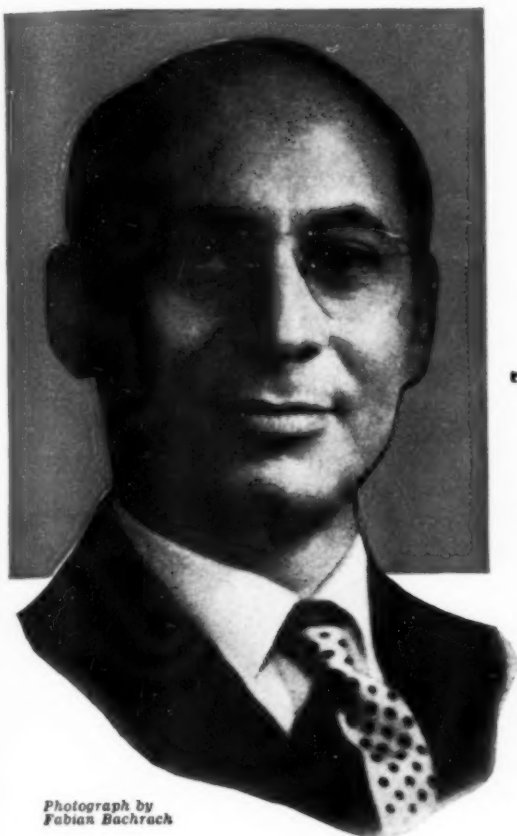
# SANGAMO ELECTRIC COMPANY

SPRINGFIELD • ILLINOIS

IN CANADA: SANGAMO COMPANY LIMITED, LEASIDE, ONT.



# **"Why we recommend Rauland to our dealers..."**



*Photograph by  
Fabian Bachrach*

*by Louis M. Herman*

*Head of The Louis M. Herman Company, Boston, and for two  
decades a leader among New England jobbers*

"Rauland television picture tubes are our choice because the aluminized tubes offered by Rauland combine highest product quality and universal acceptance by our customers as a better replacement tube than ordinary ones—better by reason of giving better definition with more brilliance and because no ion trap magnet is required, the adjustment of which is very critical. Incidentally, we have yet to experience the first failure of a Rauland picture tube. Naturally, as we profit more from better satisfied customers, we recommend Rauland to our dealers."

## **A Rauland Replacement Gives Users a "Better-than-New" Picture!**

Yes, actually users get a better picture from a Rauland aluminized replacement tube than they saw when their sets were brand new. They get better contrast... up to 80% brighter pictures... and the sharp definition that comes from the elimination of stray light. Every Rauland replacement tube means a delighted customer.

### **Eliminates Critical Ion Trap Magnet Adjustment**

Rauland's aluminized tubes need no ion trap magnet—never develop ion spot! This eliminates the danger of the replacement tube being damaged as the result of faulty adjustment of the magnet. If such damage occurs it is not protected under any tube manufacturer's warranty and the loss must be borne by the dealer or customer.

### **Boosts Filter Sales Too**

With everybody talking about filters today, you cash in with Rauland aluminized tubes, because their extra brightness gives a bright, sharp picture through even a heavy filter.

## *10 Ways Better*

1. More brilliance
2. Better contrast
3. Better definition
4. Greater fidelity
5. No ion spot
6. No cathode glow
7. No magnet
8. No circuit problem
9. Replaces any magnetic tube
10. Any filter can be used

## **THE RAULAND CORPORATION**



*Perfection Through Research*

4245 N. KNOX AVENUE • CHICAGO 41, ILLINOIS







ANOTHER SCORE IN THE

## *battle of the inches*

It takes many costly buildings to house your telephone system. Every inch saved helps keep down the cost of telephone service. So at Bell Telephone Laboratories engineers work constantly to squeeze the *size* out of telephone equipment.

In the picture a new voice frequency amplifier is being slipped into position. Featuring a Western Electric miniature vacuum tube,

tiny permalloy transformers, and special assembly techniques, it is scarcely larger than a single vacuum tube used to be. Yet it is able to boost a voice by 35 decibels. Mounted in a bay only two feet wide and 11½ feet high, 600 of the new amplifiers do work which once required a *room* full of equipment.

This kind of size reduction throughout the System means that

more parts can be housed in a given space. Telephone buildings and other installations keep on giving more service for their size — and keep down costs.

The new amplifiers, which will soon be used by the thousands throughout the Bell System to keep telephone voices up to strength, are but one example of this important phase of Laboratories' work.

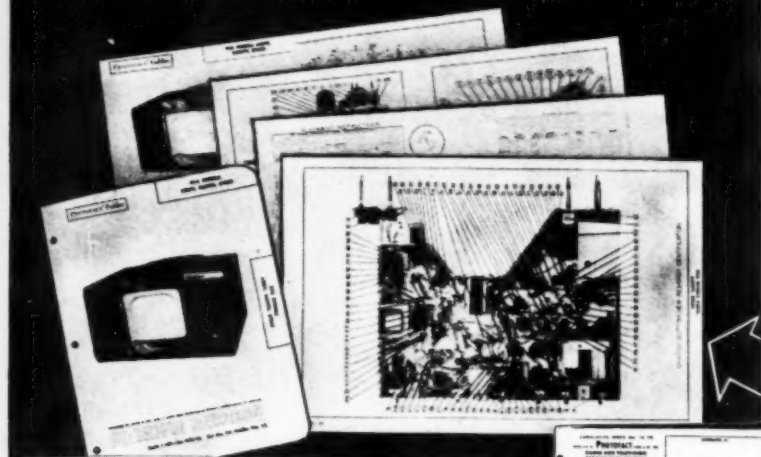
**BELL TELEPHONE LABORATORIES** EXPLORING AND INVENTING, DEVISING  
AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE



**RADIO & TELEVISION NEWS**



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**Get the Easy-Pay Details Now!**

## FREE PHOTOFACT Cumulative Index

Select your FREE PHOTOFACT Folder (covering any AM, FM or TV model) from the PHOTOFACT Cumulative Index. Get the FREE Index today. Covers all post-war receivers right up to the present. Helps you find the Folders you want in a jiffy—Folders that make your work quicker, easier, more profitable. Get this FREE Index at your Jobber or write direct for it now.

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NOW—learn for yourself—at our expense—how PHOTOFACT will make your service work quicker, easier, more profitable! Examine an actual PHOTOFACT Folder. Use it. You'll learn first-hand why this indispensable service data is used daily by over 25,000 successful service technicians. You'll discover quickly that no other service gives you PHOTOFACT's outstanding advantages: *completeness, accuracy, uniformity and ease-of-use.* PHOTOFACT alone, is the *only* radio service data prepared from laboratory analysis of the actual equipment. Nothing in the field equals PHOTOFACT. Know the facts—get your FREE Folder now. Examine it—use it—compare it—and you will understand why no modern service shop can afford to be without PHOTOFACT.



## CURRENT PHOTOFACT BEST-SELLERS

**The Recording and Reproduction of SOUND**, by Oliver Read. The complete, authoritative treatment of the entire subject of Sound, written by the editor of *Radio & Television News*. . . . . **\$5.00**

**Photofact Television Course**. The book used by thousands; gives you a clear understanding of TV principles, operation and practice. **\$3.00**

**Television Antennas**. Shows you how to select and install the proper antenna, and how to overcome antenna problems. . . . . **\$1.25**

**1948 Record Changer Manual**. Covers 45 models made in 1948, including new LP and dual-speed changers, plus leading wire recorders. Based on actual analysis of the equipment. . . . . **\$6.75**

**Auto Radio Manual**. Complete Photofact service data on more than 100 post-war auto radio models—a time-and-money-saver. **\$4.95**

**HOWARD W. SAMS & CO., INC. INDIANAPOLIS 1, IND.**

**NOTE:** This FREE offer is limited to Service Technicians. Attach coupon below to your letterhead and mention the name of your jobber. If you have no letterhead, send coupon to your jobber. Experimenters and others may obtain the Photofact Folder by remitting 50c.

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**955 N. Rural St., Indianapolis 1, Ind.**

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I am an Experimenter:

☐ Send Photofact Folder for set model . . . . .  
(50c enclosed)

Name . . . . .

Address . . . . .

City . . . . . Zone . . . . . State . . . . .



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the

**MOST  
FOR**

Your

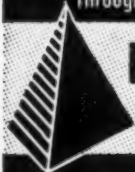
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# Within the INDUSTRY

**DR. RALPH L. POWER**, well known in advertising and publicity, will handle the press liaison work for the Los Angeles Chapter of "The Representatives" of Radio Parts Manufacturers, Inc., although George Davis will continue with the group in his capacity of chairman of the publicity committee.

Having just recently returned to his own business from his retirement, Dr. Power, who has had many years of active experience in his field, will continue operations from his offices at 767 Castelar St., Los Angeles 12, Calif.

**GERTSCH PRODUCTS, INC.**, of 11846-48 Mississippi Ave., Los Angeles 25, Calif., one of the most recent companies to enter the electronic and engineering manufacturing field, is currently in production of a Navy department order. The firm was organized following the purchase of the assets of the *Kappler Engineering and Manufacturing Corp.*

Head of the organization is E. P. Gertsch, who was works manager for the *Hoffman Radio Corp.* for four years before taking on his present duties. The factory is completely equipped for custom engineering and manufacturing on electro-mechanical lines. M. O. Kappler will remain with the corporation as chief engineer.

**R. J. CACCARELLI** has been named manager of the Chicago sales force of the *Superior Electric Company*, Bristol, Connecticut, and until permanent quarters are established, will carry on operations through Post Office Box 48, Oak Park, Ill.



Prior to his appointment, Mr. Caccarelli was in the engineering, sales, and service departments, having been employed by the firm for seven years.

**UNIVERSAL MOULDED PRODUCTS CORPORATION** will enter the electronic field with the introduction of a new type of tape recorder and other products that are the developments of *International Electronics Company*, 808 N. Broad St., Phila., Pa.

Chester C. Pond, president of *International Electronics*, will be the manager of this new division of *Universal Moulded Products Corporation*.

**THE PLANET MANUFACTURING CORPORATION**, a company newly organized for the manufacture of dry electrolytic condensers, will occupy a modern fire-resistant building located at

225 Belleville Ave., Bloomfield, New Jersey.

Corporation officers include Philip Greenspan, president; George F. Jephson, vice-president in charge of sales; Irving A. Greenfield, treasurer; and Joseph Unger, secretary.

At present the firm is producing tubular and can-type electrolytics and plans to include paper tubular condensers and noise suppression filters in its line.

**MYRON F. EDDY**, Lieut., USN Ret., will have charge of the writing and production of all of the home study lesson text and work books of the *Cleveland Institute of Radio Electronics*, in his new capacity of director of training.



In addition to these duties, Lieut. Eddy proposes to develop and expand the TV course written for this Cleveland, Ohio, school by Professor Paul H. Nelson, streamlining the engineering portions so as to better fit it to the needs of present-day service technicians.

After specializing in electrical engineering in college, Lieut. Eddy served as a radio operator and communications officer in the Naval Reserve and regular Navy for fifteen years. He is the author of "Aircraft Radio," one of the first textbooks of its kind. After retiring from the Navy, he entered the teaching field and published three other books and many articles on the subject of radio-electronics.

**ALLEN B. DuMONT LABORATORIES, INC.**, made the announcement that R. H. Macy & Co. has been re-enfranchised as an authorized DuMont television dealer, continuing the business connection that was begun last July 5 and later withdrawn as a result of a misunderstanding concerning promotion of the DuMont receivers.

In the statement issued a short time ago, DuMont and Macy representatives said that all misunderstandings have been straightened out, and the New York store will continue to carry a full line of DuMont TV sets.

**SHeldon ELECTRIC CO.**, Irvington, New Jersey, a division of *Allied Electric Products, Inc.*, proposes to enter the television field with a line of flat-face, all-glass picture tubes, according to a recent announcement, producing 10, 12½, and 16 inch sizes.

President of the firm, Nathan Chirelstein, is one of the pioneers in the radio tube field, and when *Sonatron Tube*

**RADIO & TELEVISION NEWS**



**NEW for 1950**

**New GIANT 16" PICTURE**

# MIDWEST

Celebrates its 30th YEAR of FACTORY-TO-YOU Selling with a Sensationally NEW 1950 LINE of

## TELEVISION

CONSOLES *and* Complete CHASSIS

Here is Television at its finest! ... brought to you by Midwest, for 30 years a leader in the field of radio and electronics. Immense 151-square-inch screen on new 16" metal-glass tube ... clear, steady, bright pictures ... Synchronized sound and picture that a child can tune in perfectly ... Highest quality FM sound ... Big 12" Electro-Dynamic Panasonic Speaker. Available in beautiful Television-Radio-Phonograph Consoles, as illustrated, or in complete chassis (not a kit) ready for custom installation in your own cabinet. And you can buy Midwest Television at Low Factory Prices, with Low Down Payment and Long Easy Terms —and on 30 Days Trial! Send for Catalog TODAY!



LOW  
FACTORY  
TO-YOU PRICE

**30 DAYS TRIAL**

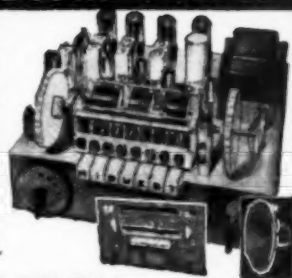
... also a Magnificent Line of NEW 1950

## MIDWEST RADIOS

featuring the latest Improved FM Circuit and the New 3-SPEED RECORD PLAYER



Powerful new 1950 Series 16 and Series 12 AM-FM Radio in complete chassis. Also beautiful new Console models including the magnificent Symphony Grand Radio-Phonograph with latest FM circuit and new 3-Speed Automatic Record Player.



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You have the fullest assurance against failures and breakdowns . . . you get long-life accuracy and stability . . . when you install Ward Leonard current controls. That's proved by performance in countless applications . . . under the most severe operating conditions. And that's why Ward Leonard Relays and Resistors are standard with so many control engineers . . . and with radio amateurs, too. You will find an economical answer to your needs in the wide range of stock types and sizes . . . at your Ward Leonard Distributor.

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## WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

RELIABLY ENGINEERED  CONTROL SERVICE



Send for  
**CATALOG D-130**  
 Gives helpful information and data on relays, resistors and rheostats. Lists the many stock types.




# Hickok

## Linearity Pattern TELEVISION GENERATOR

*World Famous*

**MODEL 620**

**THE HICKOK ELECTRICAL INSTRUMENT CO.**  
 10524 DUPONT AVE. • CLEVELAND 8, OHIO

SEE YOUR JOBBER OR WRITE FOR COMPLETE INFORMATION TODAY

Co., which he organized, became part of the *National Union Radio Corp.*, he served as president and director, later resigning to organize *Allied Electric Products, Inc.*, Sheldon, and an affiliated corporation, into their present merger.

Sheldon's production of picture tubes exceeds 500 a day, and plans are under way to step up the production to 1,000 in the next few months. Other items manufactured by *Allied Electric Products, Inc.*, include spring-action plugs, fluorescent starters, fluorescent lamp-holders, reflectors, extension cord sets, and rectifier bulbs.

**M. G. STATON**, formerly communications systems engineer, has been appointed sales manager of microwave relay and channeling equipment for the *RCA Engineering Products Department* at Camden, New Jersey. In his first position with *RCA*, Mr. Staton



worked on the field installation work on the New York-Philadelphia microwave radio relay circuit designed for the *Western Union Telegraph Company*.

Prior to joining the company in 1946, Mr. Staton supervised the conversion of telephone exchanges to automatic operation in the field of telephone plant engineering. He received his B.S. degree in electrical engineering from *Oregon State College* and served during the war as an officer in the *Army Signal Corps*, receiving the *Legion of Merit* award for his work in communications.

**LE-HI ELECTRICAL COMPANY** has removed its general offices and plant to 412 Halsey St., Newark 2, New Jersey. . . . A building and store at 3235 Prospect Ave., Cleveland 15, Ohio, is the new headquarters of the **RADIO AND ELECTRONIC PARTS CORP.**, distributors of radio and electronic equipment. . . . **ALLEN B. DuMONT LABORATORIES, INC.**, recently dedicated and opened its new television receiver assembly plant, which is located along the Passaic River in East Paterson, New Jersey. The plant covers 480,000 square feet, and the property comprises about 58 acres. . . . New home of the **JEWEL RADIO CORPORATION** plant facilities is located at 10-40 45th Ave., Long Island City, N. Y., covering more than 20,000 square feet.

**THE DIAL CORPORATION**, a newly formed company for the manufacture of instrument dials in luminescent materials has decided on 2323 W. Devon Ave., Chicago, Ill., as the location of its general offices, to be under the direction of Mr. Russ Diethert as general manager.

Mr. Diethert, who made the announcement, is well known in the electronic field through his work as head of  
*(Continued on page 112)*



Now, For the First Time—

# GUARANTEED TEST INSTRUMENT KITS

\*READ DETAILS OF UNPRECEDENTED GUARANTEE IN BOX AT BOTTOM OF THIS PAGE

THE NEW  
MODEL KT-40

## VACUUM TUBE VOLTMETER

### FEATURES

- Uses  $4\frac{1}{2}$ —2% accurate D'Arsonval type Meter with high torque movement and Alnico V slug.
- Meter guaranteed against burn-out on ALL electronic ranges. Meter will not be damaged even when improperly switched to higher range.
- Stabilized degenerative circuit results in linear D.C. scale.
- Isolating test-prod for all D.C. Voltage ranges.
- Megohm input resistance on all D.C. ranges.
- Ohmmeter accurately measures from 1/10th ohm to 1 billion ohms.

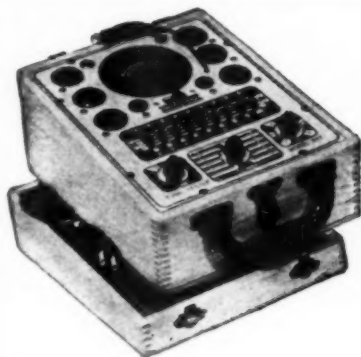
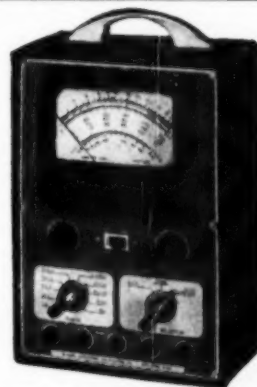
### SPECIFICATIONS

- D.C. VOLTS: (At 11 megohms input resistance) 0 to 3/30/150/750/1500 Volts.
- A.C. VOLTS: (At 1,000 ohms per Volt) 0 to 3/30/-150/750/1,500 Volts.
- RESISTANCE: 0 to 1,000/10,000/100,000 ohms. 0 to 10 megohms/1,000 megohms.
- D.B. Based on 0Db equals .006 watts (6 milliwatts) into a 500 ohm line.  
-24 db to +4 db                      +10 db to +38 db  
-4 db to +24 db                      +30 db to +58 db

Model KT-40 Completely Wired  
Ready to Operate \$29.50

Model KT-40 Kit comes complete with all parts including test leads. V.T.V.M. prod. circuit, operating instructions, etc. Net only.....

**\$19<sup>90</sup>**  
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THE NEW  
MODEL 247

## TUBE TESTER

Check octals, loctals, bantam Jr. peanuts, television miniatures, magic eye, hearing aids, thyratrons, the new type H. F. miniatures, etc.

### FEATURES

- Newly designed element selector switch reduces the possibility of obsolescence to an absolute minimum.
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- The Model 247 provides a supersensitive method of checking for shorts and leakages up to 5 Megohms between any and all of the terminals.

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Model 247 Completely Wired  
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Model 247 Kit comes with all parts, new speed-read chart, handsome hand-rubbed oak cabinet sloped for bench use. A slip-on hinged cover is included for outside use.....

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THE NEW  
MODEL B-450

## SIGNAL GENERATOR

### SPECIFICATIONS

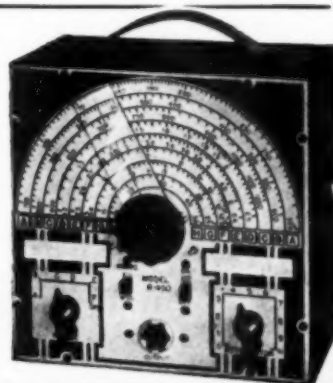
- Frequency Range: 150 Kilocycles to 50 Megacycles.
- F.M. as well as A.M. receivers can be speedily aligned with the aid of the Model B-450. Modulation in the B-450 is accomplished by Grid-blocking action which has proven to be equally effective for alignment of amplitude as well as for frequency-modulated receivers.
- R.F. is obtainable separately or modulated by Audio Frequency.
- Positive action Attenuator provides effective output control at all times.

- The R.F. Signal Frequency is kept completely constant at all output levels. This is accomplished by use of a special grid loaded circuit which provides a constant load on the oscillatory circuit. A grounded plate oscillator is used for additional frequency stability.
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Model B-450 Completely Wired  
Ready to Operate \$24.50

Model B-450 Kit comes complete with all parts including circuit, test leads, etc. Nothing else to buy.....

**\$18<sup>50</sup>**  
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## \* UNPRECEDENTED GUARANTEE!!

All kits advertised on this page are offered subject to the following guarantee: If, after completion, the instrument does not operate to your fullest satisfaction, you may return it and we will ship you a brand new factory wired and tested model for only the difference between the price of the Kit and the price of the complete Instrument. Full credit will be given no matter what stage of completion has been reached in wiring the Kit.

20% Deposit Required on All C.O.D. Orders

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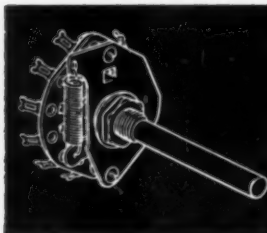


# Centralab Reports to

USE CRL SWITCHES

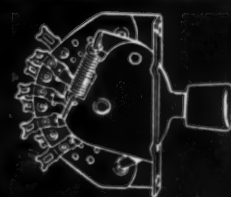


**Y**OU can take your choice when you ask for Centralab Rotary Selector Switches. For general all-around use, there's the CRL model with stators of high quality laminated phenolic as shown here.. This popular insulation gives you high mechanical strength, low moisture absorption, high dielectric strength and low power factor. For critical circuit applications—it's Centralab's Rotary Switch insulated with Grade L-5 Steatite. This is the perfect insulation for high and ultra high frequency requirements. It's impervious to moisture and temperature extremes. It has the highest mechanical strength in the family of ceramic materials. The following specifications apply to both types of CRL Rotary Selector Switches. Rating: 6 watts. Contacts: Spring brass, silver plated, self-cleaning. Shorting or non-shorting. Bushing: Cadmium plated,  $\frac{3}{8}$ " x 32 thd.,  $\frac{3}{8}$ " long. Shaft:  $1\frac{1}{8}$ " long from end of bushing. Index: Positive, 30°. Adjustable stop. Supplied with: Bar knob, mounting nut and lockwasher. Separate index and separate sections are also available.



Coil spring of Centralab's new Coil and Cam Index Switch gives you smoother action... guaranteed minimum life of 150,000 cycles.

30



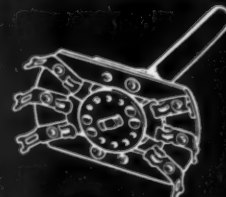
CRL Lever Switch provides positive indexing. Like Coil and Cam Index Switch, spring can be replaced without removing switch from chassis.



Tone Switches are used for step-type tone control circuits; off-on, talk-listen and band change applications; inter-com station selectors.



This Tone-Switch is single-pole, three-position selector type with shorting contacts. Like all CRL Tone Switches, it gives you long life.



Double-pole, double-throw Tone Switch, is versatile, may also be used as single-pole, double-throw or single-pole, single throw switch.

RADIO & TELEVISION NEWS

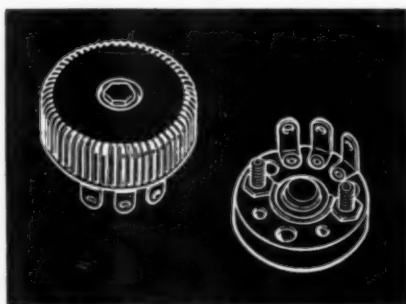


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*The right switch, control or capacitor carries the name "Centralab." It's right for your customers because high quality Centralab parts mean better performance . . . longer life. It's right for you because the satisfaction it gives your customers means more repeat business . . . more new customers. Yes, compare quality . . . compare performance . . . compare wide selection . . . compare easy availability, and you'll see why successful radio servicemen everywhere use CRL parts to build up their business. For the complete story on the Centralab line, see your Centralab Distributor today.*

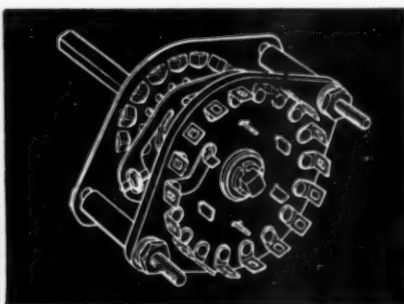
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## Ask Your Distributor for These CRL Parts



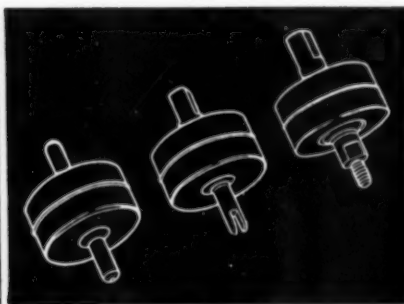
### CONTROLS

MODEL "M" for voltage-divider antenna shunt and "C" bias control, tone control, AF grid control. MODEL "1" for all miniature applications such as hearing aids, portable radio receivers; rated at 1/10 watt, actually smaller than a dime. MODEL "R", wire wound, for voltage divider, antenna shunt, "C" bias, AF grid or tone control circuits.



### SWITCHES

ROTARY for band change, meter, intercom circuits; made in ceramic and phenolic models. ROTARY SPRING RETURN for meter selection, intercom, phono-radio applications. MEDIUM DUTY for band changing in low power exciter-transmitters and receivers. LEVER ACTION for intercom, speaker, microphone and other applications.



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TC HI-KAPS for correcting temperature drift in TV, FM, AM, VFO circuits. BC and KOLORDISK HI-KAPS for by-pass and coupling applications in non-resonant, TV, AM, FM, AF, HF, VHF, UHF circuits. HI-VO-KAPS for TV power supplies. CERAMIC TRIMMERS for padder applications in TV, AM, FM, and HF circuits.



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## New!

MODEL 303

### VACUUM TUBE VOLT-OHMMETER

... A Worthy Companion  
of the 260



#### SPECIFICATIONS

**DC Voltage**  
Ranges—1.2, 12, 60, 300, 1200 (30,000 with Accessory High Voltage Probe)  
Input Resistance—10 megohms for all ranges  
DC Probe—with one megohm isolating resistor  
Polarity reversing switch

**Ohms**  
Ranges—1000 (10 ohms center)  
100,000 (1000 ohms center)  
1 megohm (10,000 ohms center)  
10 megohms (100,000 ohms center)  
1000 megohms (10 megohms center)

**AC Voltage**  
Ranges—1.2, 12, 60, 300, 1200  
Impedance (with cable) approx. 200 mmf shunted by 275,000 ohms

**AF Voltage**  
Ranges—1.2, 12, 60  
Frequency Response—Flat to 100,000 cycles

**Decibels**  
Ranges—-20 to +3, -10 to +23, +4 to +37,  
+18 to +51, +30 to +63  
Zero Power Level—1 M. W., 600 ohms

**Galvanometer**  
Zero center for FM discriminator alignment and other galvanometer applications

**R. F. Voltage**  
(Signal tracing with Accessory High Frequency Crystal Probe)  
Range—20 volts maximum  
Frequency—Flat 20 KC to 100 M.C.  
105-125 V., 60 cycles

**Size** 5 1/4" x 7" x 3 1/4" (bakelite case). Weight: 4 lbs.  
Shipping Wt.: 6 1/2 lbs.

**Dealer's Net Price** Model 303, including DCV Probe, ACV—Ohms probe and Ground Lead—\$58.75; Accessory High Frequency Probe, \$7.50  
Accessory High Voltage Probe, \$14.85  
Also available with roll top case, Model 303RT—\$64.75



#### Smaller and Handier for Greater Portability

A worthy companion of the world-famous Model 260 is this brand new addition to the Simpson line—the Model 303!

Skilled Simpson engineers spent months of painstaking research in the laboratory to produce the Model 303, which is one of the most versatile instruments ever made for TV servicing. This ruggedly constructed instrument offers the maximum in portability because it is approximately 60% smaller than other vacuum tube volt-ohmmeters. However, no sacrifice has been made in readability. The 303 has a large 4 1/2" meter, despite its handy compactness.

One of the many features of the 303 is its low current consumption. The AC voltage range is wider than on any other similar instrument—from 1.2 volts minimum to 1,200 maximum. Like all other instruments bearing the Simpson name, the Model 303 is an instrument of highest quality at an amazingly low price.

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*Gives You these Advanced Features for Modern AM, FM and TV Servicing*

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Lustrous nickel-plated finish and distinctive blue base are combined with a smoother "cushioned turn" to give you a control that looks, "feels" and performs better than any you've ever used.

## KNOB MASTER FIXED SHAFT

This 3" long fixed shaft is standard on the Q Control. 90% of all AM, FM and TV  $\frac{1}{4}$ " knobs can be accommodated without alteration, except cutting to length. It is knurled, flatted and slotted, and ends spread easily for worn or oversize knobs. Shaft inserts are no longer needed.

The Knob Master Fixed Shaft combines with compact  $\frac{15}{16}$ " design and  $\frac{1}{4}$ " long bushing to provide the industry's most adaptable small control.

enlarged  
cross-section

## 11 INTERCHANGEABLE FIXED SHAFTS

Now it's easy to adapt standard controls to "specials". Resilient Retainer Ring, an outstanding control design advancement, permits ready adaptability to any of 11 special FIXED shafts in less than a minute—using only a knife or screwdriver. Shafts are FIXED and permanent! They will not wobble.

Interchangeable Fixed Shafts are sealed in cellophane and individually packaged. Simple instructions are included in each carton.

REVOLUTIONARY  
TYPE Q CONTROL  
LEADS THE FIELD IN  
CONVENIENCE FEATURES

### OUTSTANDING APPEARANCE VERSATILE KNOB MASTER SHAFT INTERCHANGEABLE FIXED SHAFTS MODERN SMALL SIZE SMOOTHER ROTATION

Resilient Retainer Ring provides cushioned turn—a new sensation in operation

### PRE-EMINENT ELECTRICAL FEATURES

$\frac{1}{2}$  watt rating—wider coverage  
Famous IRC resistance element  
Identical electrical rotation with or without switch  
Wider range—500 ohms to 10 megohms

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Molded base accurately aligns parts  
Salt spray materials and finishes  
Two locating lugs provided

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Complete mechanization of production and testing eliminates hand operations and assures maximum uniformity

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Write now for Data Sheet No. 152 describing all the new loudspeakers in the Jensen Genuine Wide-Range series, and booklet "Let Music Come to Life!"

## NEW — WIDE ANGLE ACOUSTIC LENS

Typical of Jensen leadership in loudspeaker engineering is the acoustic diverging lens used on the H-510 Coaxial illustrated above. Adapting optical principles to acoustics, this lens acts in conjunction with the h-f horn to distribute h-f radiation uniformly over a wide angle . . . insures constant balance and high quality reproduction throughout the whole room.

This trademark identifies an advanced design loudspeaker . . . with performance to meet today's exacting requirements for faithful music reproduction . . . achieved through the most modern applications of acoustics.

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# LOUDSPEAKER ENCLOSURES

By  
**JOHN D. GOODELL**

Minnesota Electronics Corp.



Compact corner cabinet design, using fifteen-inch cone, extends the low-frequency response per cubic foot of enclosure volume.

less than a quarter-wavelength, there will be an undesirable effect on performance. In general, this appears as an increase in the resonant frequency and faulty reproduction of low frequencies. If this approach is the only practical method for a particular installation, it is worthwhile to line the enclosure with absorptive material. In general, such installations should be avoided, and if a closet is used, the spaces should be modified in accordance with the design of furniture-type cabinets. In other words, a suitable cabinet may be built into a closet, but simple mounting of the speaker in the door of a closet is far from ideal.

## Vented Cabinets

The "bass reflex" type of cabinet is probably the most popular and widely-used basic design. Although this structure has many advantages when properly designed, it is not as simple in principle as is generally believed. It is quite easy for the amateur to produce very undesirable results with a bass reflex enclosure that is not coordinated properly with the characteristics of the loudspeaker unit used. Within certain limits, it is possible to obtain better low-frequency response from a bass reflex cabinet of minimum dimensions than from any other type. This is used to advantage where cabinets must be built with very small cubic content, but the size has often been carried to extremes that are misleading to the average observer. Many people have condemned this type of design on the basis of observing the results obtained with a very small cabinet. It must be recognized that there is no known method of generating satisfactory low frequencies from very small cabinets, and that a bass reflex design may help but can never compensate completely for such limitations.

## *A review of the principles involved in selecting loudspeaker enclosures for various applications.*

**M**UCH of the data given are presented in practical "rule of thumb" form rather than as rigorous theoretical exposition. There are several basic types of enclosures and innumerable variations of them.

### Flat Baffles

This is the simplest mounting for a cone type, direct radiator loudspeaker. The baffle functions to separate the front and back waveforms and to prevent cancellation effects between them. The success with which this is accomplished depends largely upon the size of the baffle, which, ideally, would be infinite. This is approximated where the loudspeaker is mounted in a wall between two relatively large rooms. The advantages of a flat baffle are that it is a simple structure physically, it does not tend to introduce undesirable cavity resonances, such as are obtained with many cabinet designs, and, where it consists of a wall, no floor space is taken up by the loudspeaker.

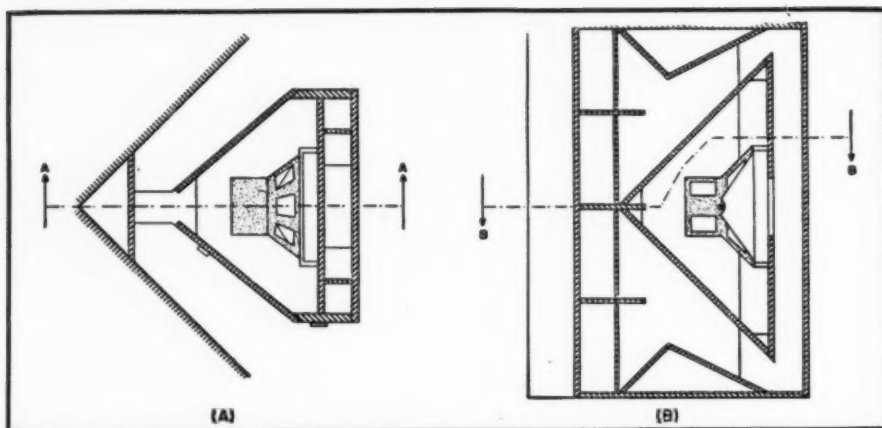
The principal disadvantages are that there is poor loading of the loudspeaker cone at low frequencies, and the low-frequency energy is transmitted to the air with poor efficiency. Another disadvantage is that the directional effects of the very-high frequencies are not compensated for by

a flat baffle, and the high frequency distribution is unsatisfactory. With flat baffles, as with all loudspeaker housings, it is important that the material used be sufficiently heavy and well damped to prevent vibration of the baffle. This means that plywood baffles must be at least  $\frac{3}{4}$ " thick and, if large, should be braced by heavy cross pieces or deadened with pads of acoustic material. The characteristics of flat baffles are desirable only when it is unnecessary or unimportant to reproduce the extremes of the audio spectrum. However, it is undoubtedly better to use a flat baffle, particularly a wall, than to mount the loudspeaker in the cabinet with other components, where the acoustic design is almost invariably unsatisfactory and tends to introduce hang-over effects and peaks in the response curve.

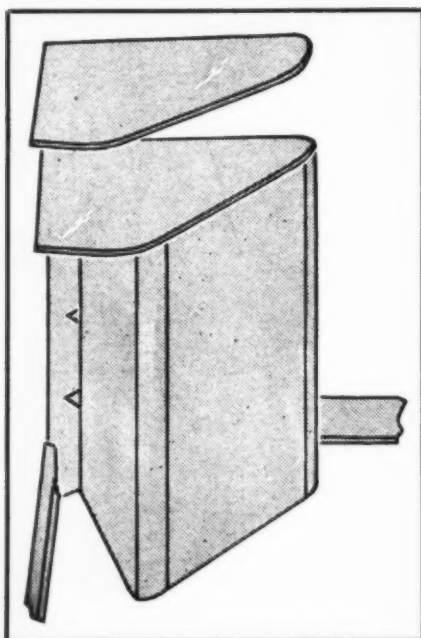
When the loudspeaker is mounted in a wall with a relatively large room on each side, it is practical to consider the structure in terms of a flat baffle. When the room at the rear is small, approaching the dimensions of a standard type of cabinet, other problems are involved. The effects begin to have importance when the speaker is mounted in the door of a relatively small closet.

At any frequency where the maximum dimension of the enclosure is





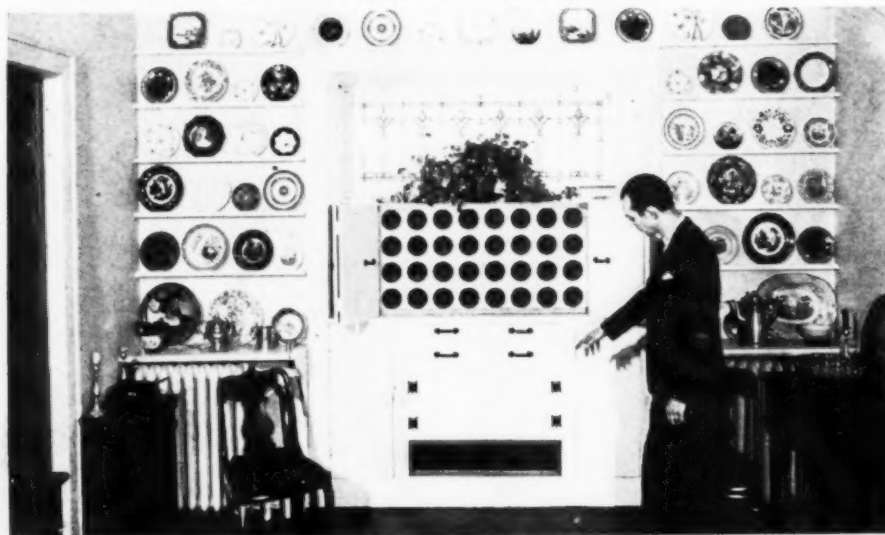
The Klipschorn corner cabinet with 15" motor reproduces frequencies down to 30 c.p.s., yet occupies only 15 cubic ft. Comparable theater systems require 60 cubic ft. or more.



Corner type cabinet, occupying only 15 cubic ft., with frequency range from 30 to 500 c.p.s. Space above the cabinet is a mounting space for high-frequency horn.

Well-designed bass reflex cabinets are capable of excellent results. Many manufacturers provide such cabinets to accommodate their loudspeakers, and others make drawings available. It is usually more desirable to use the dimensions given by the loudspeaker manufacturer rather than to attempt to design such a cabinet without adequate facilities for measurement of the results. However, it should be mentioned that the manufacturer also sometimes makes compromises between optimum performance and space requirements because he knows that the average customer will not tolerate a cabinet as large as is necessary for the best possible results. Bass reflex cabinets, when properly designed, are capable of increasing the low-frequency response with a given cabinet dimension, decreasing the cone excursion required for a given low-frequency intensity, and thus lowering the distortion from excessive cone motion. They rarely provide satisfactory radiation as low as 50 cycles, and designs that are improper have a tendency toward resonant hang-over effects at low frequencies. It is almost never satisfac-

Custom home installation using 32 special small speakers, producing exceptionally wide-range response with low distortion and desirable spatial distribution of source. Note particularly the wide labyrinth port near baseboard.



tory to place a loudspeaker made by one manufacturer in a cabinet designed by another.

For the experimenter who wishes to investigate such cabinets on a cut-and-try basis, the following suggestions are given. It is well to start with a design that at least approximates the recommendations of the manufacturer. It is possible to adjust the characteristics considerably by changing the placement and size of the damping pads used inside the enclosure. The basic purpose of the damping pads is to absorb the middle and higher frequencies where destructive interference will result from radiation through the port. The port should be placed close to the loudspeaker opening so as to take advantage of the mutual radiation impedance (in-phase simultaneous compression of the air between the two openings tends to reinforce the transfer of energy to the air). The characteristics may also be changed by adjusting the size of the port. The port should initially be made larger than the expected optimum and then tuned with sliding panels. This means that the initial size of the port should be greater in area than the area of the cone used.

One method of adjusting the size of the port is to apply a signal from a dry-cell flashlight battery to the speaker terminals periodically. When the signal is applied, there will be a distinct click as the d.c. impulse displaces the speaker cone. When the signal is removed, the speaker cone will return to its normal position and will generate another sound. If the sound generated when the speaker returns to its rest position is also a relatively sharp click, the enclosure may be considered as providing satisfactory damping of the cone, and low-frequency hang-over effects will be minimized. If the damping is poor, the speaker cone will oscillate before returning to rest and generate a sound that hangs on slightly, ringing with a "rain barrel" effect. Adjusting the port will aid in obtaining the desirable double click.

Another method of adjusting the port is to apply a signal from an oscillator and adjust the port for maximum output at the lowest frequency it is possible to generate with reasonable intensity. One danger in this system is that it is often difficult to differentiate, when listening, between the true fundamental and the second harmonic, although with practice this can be learned.

Since the characteristics of the room greatly affect the low-frequency response, it is often worthwhile to make adjustments of this kind even in cabinets that are assumed to be properly designed by the manufacturer. Surprisingly, it is sometimes desirable simply to remove the back from such a cabinet and close up the port; success of the experiment will depend on the specific room in which the cabinet is used and the location of the cabinet therein. This does happen often enough



to make it worthwhile trying in most locations. In any event, it is an interesting opportunity to observe the characteristics of the bass reflex enclosure as opposed to the simple, open-back cabinet in various room locations.

The only method for obtaining optimum results is to listen to a wide variety of signals with the cabinet in various positions and with all possible adjustments varied periodically. However, it takes a great deal of listening to a great many different types of signals on various systems to develop the ability to make such judgments with accuracy. It is very, very easy to be fooled by the signal source, the characteristics of your own hearing at any given time, and dozens of other variables. The same observations should be made while listening in various parts of the room. A system may be adjusted for excellent reproduction from one listening position and yet turn out to be most unsatisfactory for other locations. Hours may be spent in making adjustments while listening in one location, and how disappointing it is to find that the results are far from optimum for the general spaces in the room.

#### Corner Cabinets

A distinct line cannot be drawn between wall mounting of loudspeakers that should be considered strictly flat baffle arrangements and those that partake of horn characteristics. In general, it is desirable to mount a loudspeaker, whether it be in a cabinet or in a wall, as close as possible to 2 or more wall junctions. The simplest explanation for this is that the walls then function roughly as the sides of a horn and aid in projecting the energy into the room. Obviously a corner placement is ideal from this standpoint. The principal reinforcement obtained with corner locations is at the low frequency end of the spectrum. However, since the high frequencies tend to beam, it is clearly desirable to locate the loudspeaker in a position where the angle between the center beam of the loudspeaker and the listener is minimized. In a corner location the maximum angle that will appear in any listening position between the focus line of the loudspeaker and the listener is 45 degrees. This same principle dictates the placement of a cabinet at the end of a rectangular room rather than along the side wall.

In many corner cabinets the rear radiation is guided back along the walls of the room to reinforce the low-frequency response from the loudspeaker. The corner cabinet designed by Paul Klipsch constitutes a folded horn that radiates frequencies as low as 30 cycles with remarkable efficiency. In this design the radiation from only one side of the loudspeaker is used. The walls of such an enclosure absorb the majority of the energy above approximately 1500 cycles, and it is necessary to use a separate



Multiple loudspeakers in custom radio-phonograph-pipeless organ installation.

unit for high-frequency reproduction.

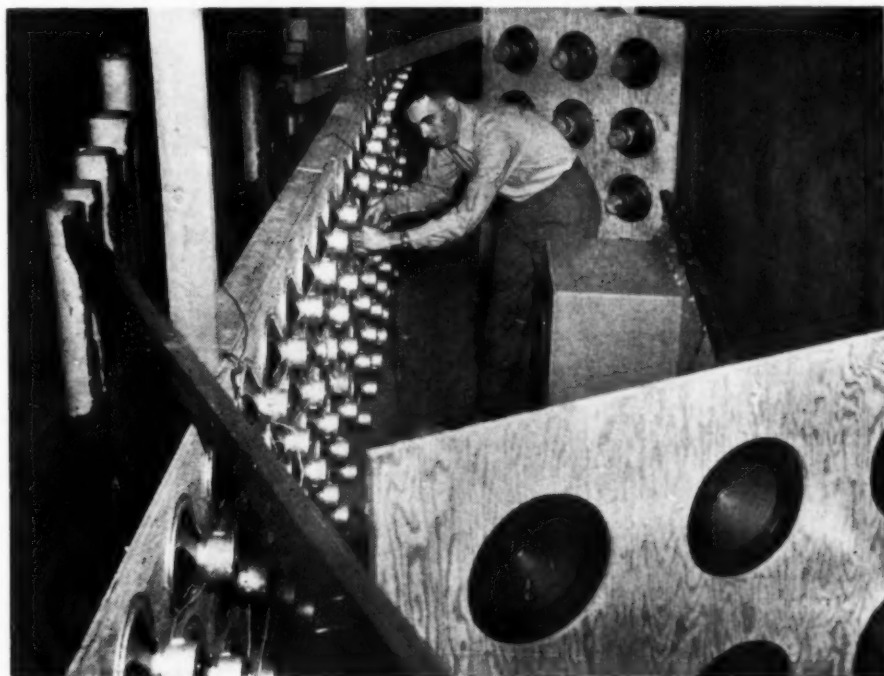
It is entirely possible to combine the bass reflex principle with corner cabinet design. However, with corner cabinets it is usually practical to achieve equal or superior results with the rear radiation guided along the walls, and there is less danger of cabinet resonance. On the other hand, the bass reflex design is attractive because of its ability to minimize cone excursions for a given low-frequency radiation. Where adequate space is available it is probably better not to combine the two designs, but where

maximum low-frequency radiation is desired with a minimum of space, the bass reflex corner cabinet is definitely indicated.

One other feature of the corner arrangement that is now becoming important is the fact that combining a television screen with a corner speaker cabinet results in the most efficient use of the room area for visual observations at minimum angles.

In motion picture theater installations, one of the important considerations is the matter of preserving the

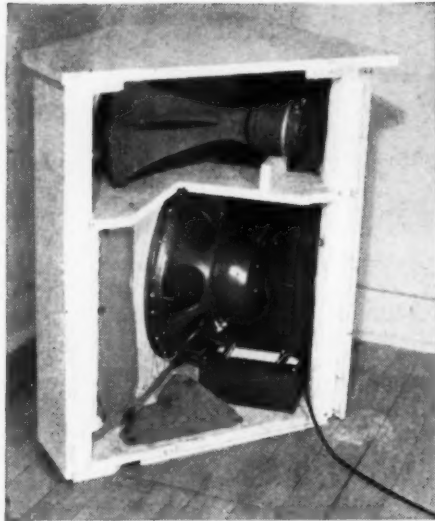
An experimental installation of one hundred special 8-inch loudspeakers and twenty-four 10-inch units on the catwalk above the organ chamber. Provides diffuse high-frequency sound source and good radiation as low as 32 cycles-per-sec.







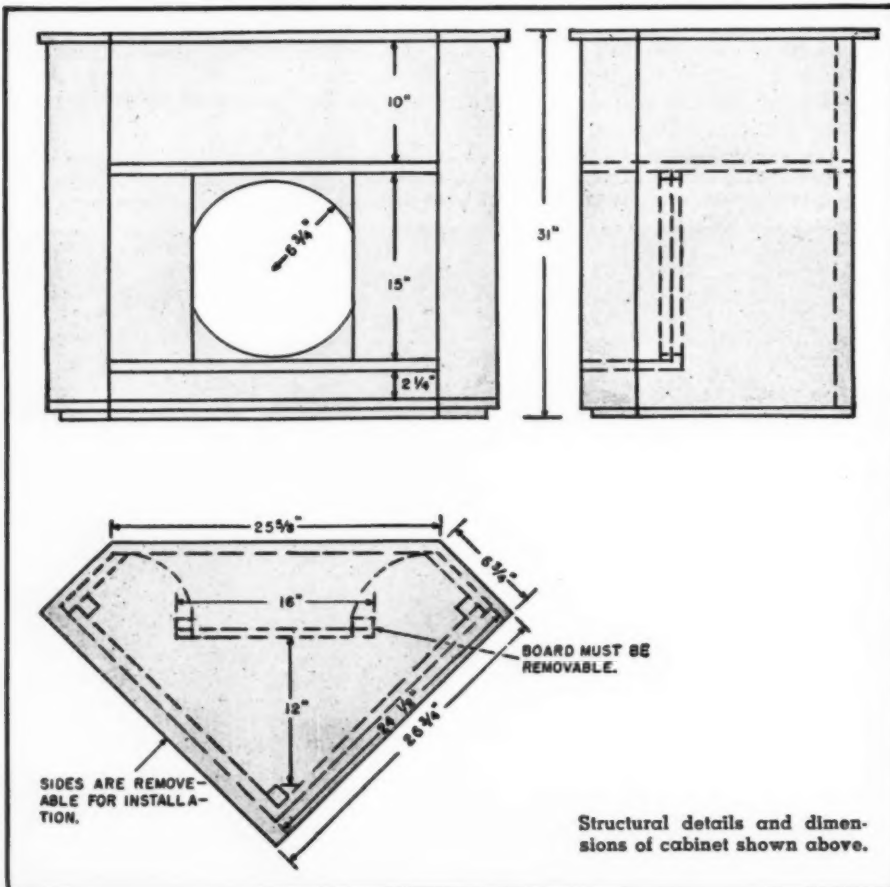
Front view of a corner cabinet designed for a dual-channel speaker system.



illusion that the sound comes from the performer on the screen. In working with these problems, it has been determined that the ratio of sound coming directly from the loudspeaker system and the sound coming from reflecting surfaces is extremely important. In these installations the engineer strives to keep the ratio high, with the majority of the sound reaching the listener directly from the loudspeaker units. In music reproducing installations, particularly in the home, the opposite effect is often desired. Live music rarely emanates from a point source as restricted in size as a loudspeaker cabinet.

Auditory perspective is an important part of the illusion, and it may be approximated by deliberately introducing a condition where a large portion of the sound reaches the observer from reflecting surfaces rather than directly from the loudspeaker. It is partially because of the important contribution to realism made by this effect that many people have found it desirable to place loudspeakers in rooms adjacent to the listening location. Other experimenters have found that placing loudspeaker units so that they face the wall away from the listening location at angles to

Interior of above installation with side removed. Cut-away section of top shelf allows upper section to form a second port for low-frequency reinforcement.



produce reflections via the side walls increases the illusion of auditory perspective. In most installations it is worthwhile to experiment with effects of this kind, and often the results obtained will be startlingly successful.

There is one disadvantage in using the reflecting walls exclusively to distribute the sound energy. This is the fact that the very high frequencies tend to become absorbed under these conditions, and brilliance is sacrificed. The extent to which this will be observed depends partly on the reflecting characteristics of the walls. Obviously, very hard plaster walls will tend to reflect a large percentage of the energy. Draperies, wood, and absorptive materials of all kinds will reduce the high-frequency response observed from such a system. It is well to bear in mind that almost all materials tend to absorb high frequencies to a greater degree than they do the middle and low frequencies. In spite of this consideration, there is often sufficient contribution to the realism of reproduction to compensate for some loss of brilliance. The audio engineer has a tendency to lose sight of the over-all effectiveness of a music reproduction system in the effort to retain the widest possible frequency response. With many commercial signal sources, some losses at the extreme high end are not only tolerable but desirable since the majority of the content is noise rather than music.

Another method of achieving a "spread" source of sound, together with other desirable results, is to use a large number of small coned speakers. Thirty or more properly designed five- or six-inch loudspeakers mounted in a bank at one end of a long living room are capable of remarkably realistic reproduction. In such installations each speaker unit is required to handle so small a portion of the energy that distortion is reduced to a minimum, the lightness of the small cones makes good high-frequency reproduction possible, and the mutual radiation impedance of large clusters provides efficient low-frequency radiation. At very low frequencies, the cones function as a single unit to move a wall of air. At high frequencies they act individually to provide wide-angle distribution of the energy.

Since relatively inexpensive units may be used, it is often possible to make such an installation at a cost equal to or lower than a conventional system. It is usually desirable to mount the speakers very close together with a slight arc across the surface of the baffle to effect optimum distribution and reduce any tendency to focus. In large rooms as many as a hundred units in a bank have been used successfully. This sounds as though it would require a great deal of space, but a little consideration will reveal that the space factor is not serious. A bank of five-

(Continued on page 118)



# High-Quality AMPLIFIER DESIGN

By  
**GLEN SOUTHWORTH**

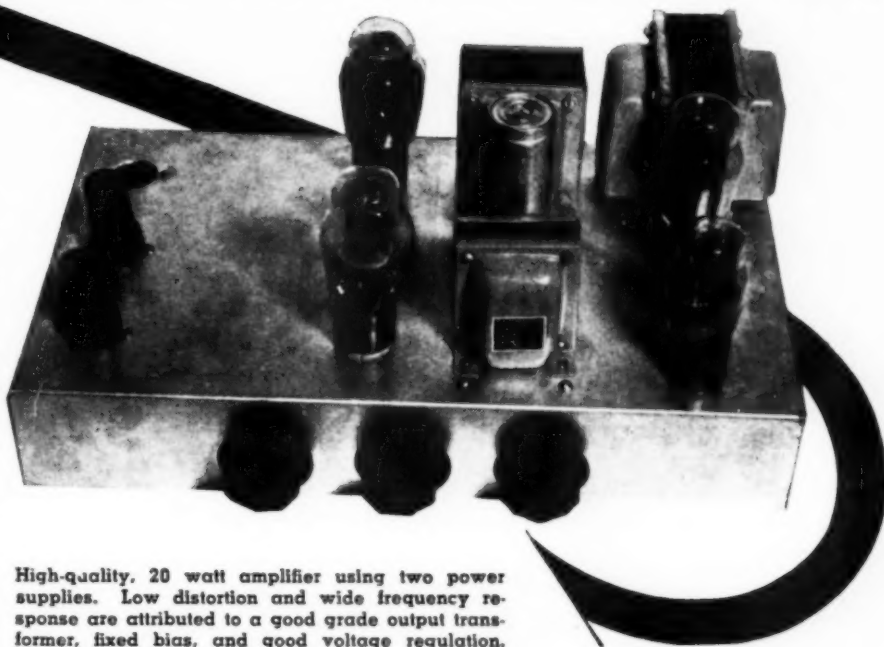
**T**HE audio amplifier appears to rank high in popularity with the constructor and experimenter. Several reasons might be advanced for this; however, an advanced appreciation of good reproduction, brought about by high-quality FM broadcasts and new recording developments, is undoubtedly a very important consideration. As a result, a desire for good equipment at moderate cost has encouraged many technically-minded listeners to assemble their own equipment from component parts, often with considerable savings over ready-made assemblies.

Unfortunately, home constructors and experimenters are many times faced with the serious handicap of unfamiliarity with new circuits, combined with a lack of adequate testing facilities. As a result, equipment on which considerable time and money has been spent may fall far short of the desired performance. A knowledge of simple testing techniques and likely sources of distortion is therefore very desirable.

In judging audio amplifiers, a number of factors are usually considered, including power output, frequency response, harmonic distortion, and, in recent years, intermodulation distortion and the several other forms of not uncommon distortion. The relative importance of these various factors is subject to controversy and, of course, will be influenced by the particular application to which the amplifier is put and the associated equipment used.

Considering power output, an amplifier may be rated as follows: At maximum power output on a single frequency, at output at a certain percentage of harmonic distortion on a single frequency, or, more rigorously, at output over the entire usable frequency range at a given percentage of distortion. In recent years, ratings at percentages of intermodulation distortion are often given. Needless to say, the power rating of a particular amplifier will vary greatly, depending upon the standards used.

An important consideration in power requirements for sound reproduction is loudspeaker efficiency. Some high-quality loudspeakers may have efficiencies approaching fifty per-cent, while it is generally considered that



High-quality, 20 watt amplifier using two power supplies. Low distortion and wide frequency response are attributed to a good grade output transformer, fixed bias, and good voltage regulation. Two tone controls and power outlet for external pre-amp shown are not illustrated in the schematic.

## ***Simple testing techniques used to evaluate various forms of distortion prevalent in audio amplifiers.***

less expensive, conventional speakers have efficiencies on the order of ten per-cent. As a result, it may require a 50 watt amplifier used with low-efficiency speakers to achieve the same sound intensity produced by a 10 watt amplifier driving high-efficiency speakers.

Another important problem relating to power output requirements is the fact that in reproducing speech and music, an amplifier is almost always handling complex waves which may impose a severe limitation on the amount of undistorted power output. The reason for this is that conventional amplifiers are essentially two-dimensional devices; therefore, when two or more frequencies are being handled at the same time, the higher frequencies will be superimposed upon the lower. As a result, the undistorted output available will decrease as the complexity of the waveform handled increases. In high-quality reproduction, this may mean a power reduction of 10 to 20 db. compared to the single frequency sine wave capabilities of the amplifier.

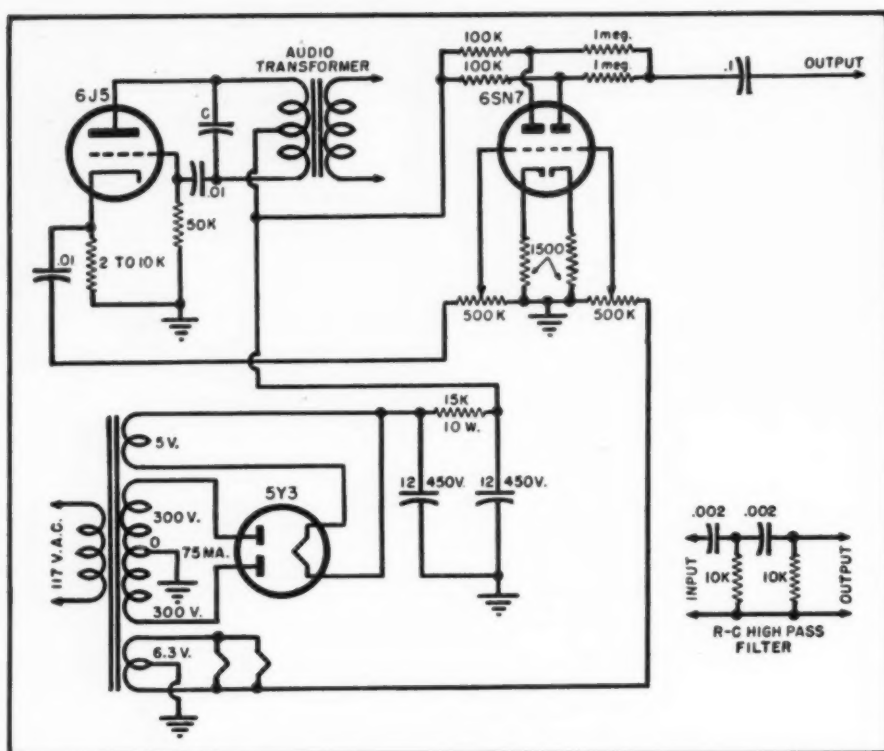
An interesting method of increasing amplifier efficiency is through the use of multiple-channel amplification. The simplification of complex waveforms

through frequency division in a two channel system may give efficiencies approximately double that of a conventional system, although this will depend to a degree on the crossover frequency used and the frequency range of the input signal.

Because it more closely approximates actual operating conditions, intermodulation distortion measurement has been the subject of considerable interest in recent years. Intermodulation distortion may result from several factors, one of which is the fact that the low-frequency component of a complex wave acts as a continually-varying grid bias. Due to this condition, the high-frequency component is amplified under ideal conditions, e.g., the center portion of the straight part of the tube curve, for only small portions of the low-frequency cycle. On peaks of the low-frequency cycle, the high frequency may be biased to a point near plate saturation or cut-off with resulting severe harmonic distortion and reduction in output.

Push-pull output transformers may represent a serious cause of distortion if their efficiency is dependent upon having low values of unbalanced direct current in the primary wind-

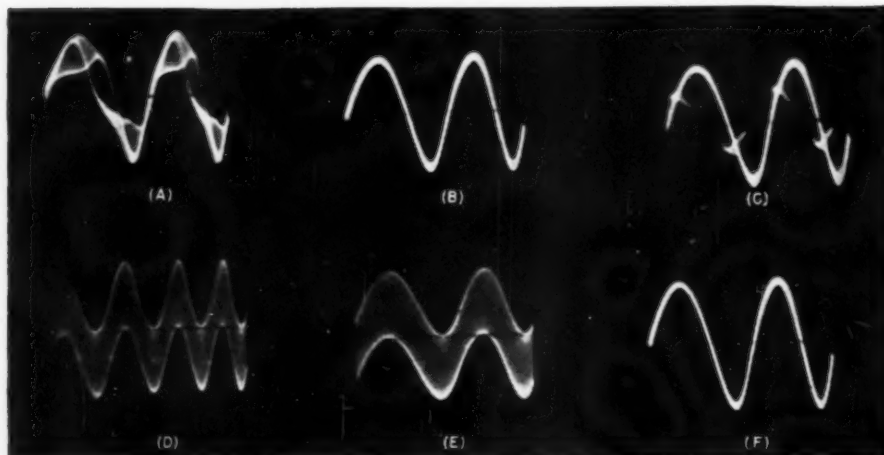




ings. Under actual operating conditions, low-frequency components will cause considerable dynamic unbalance in the output transformer with consequent distortion and lowered output in a poorly-designed unit. One test of output transformer quality is to remove one of the push-pull output tubes, if this can be done without seriously upsetting the circuit, and operate the amplifier with single-ended output. With a good transformer, frequency response and power output capabilities should be fairly constant from about 100 cycles, on up.

the frequency response may drop off badly below 1000 cycles, and the undistorted power output at both high and low frequencies may be greatly diminished. In units of similar nature, the frequency response is often a function of the load impedance, and low frequency efficiency usually increases as the load resistance increases. This means that at speaker resonance, where the speaker impedance may rise to a fairly high value, the low frequency efficiency of the amplifier may increase materially, thereby contributing to speaker hang-over.

Oscilloscope traces illustrating various patterns encountered in intermodulation analysis: (A) Excessive modulation of high-frequency component produced by self-biased, push-pull 6L6 amplifier at 10 watts. (B) Same amplifier using fixed bias and at 20 watts output. (C) Same amplifier overdriven with harmonic distortion of the high-frequency component resulting. (D) The 60 and 3000 cycles mixed one to one with sweep set to show 60 cycle component. (E) Same frequencies with sweep set to show 3000 cycle component. (F) Output of high-pass filter.



Inverse feedback may be used to reduce this effect and is often of decided benefit with low-grade output transformers, although the amount of feedback obtainable with these units is often not very great. Similar results may be obtained through the use of low impedance output tubes such as triodes; however, it is worthwhile to note that excellent frequency characteristics have been observed with high-quality transformers operating under conditions of excessive mismatch in circuits using beam power tubes without feedback.

Several factors should be mentioned in connection with intermodulation distortion. One is the fact that modulation is usually negative, with the result that an actual reduction in intensity of modulated frequency occurs. In some cases, a phenomenon known as "masking" may result from the suppression of low-level components in this manner. Low frequencies may suffer likewise in a nonlinear system due to the tendency of a high-intensity high frequency to "average" the tube characteristics, with a resultant decrease in gain of the low-frequency component. A similar effect is brought about by the use of high-frequency bias in magnetic recordings; an actual reduction in distortion may occur.

Although considerable emphasis has been placed on the fact that nonharmonic sum and difference frequencies of an objectionable nature may be produced by intermodulation distortion, it should be realized that in many cases true modulation does not occur; rather, the high-frequency component undergoes severe harmonic distortion. Fig. A of the oscilloscope photographs illustrates this.

The modulated portions of the wave show decided departure from sine-wave shapes. True modulation would be indicated by a thickening of the peaks of the wave without any departure from the sine-wave form. The resultant strong harmonic distortion may prove to be more objectionable than the sum and difference frequencies generated. Fig. C in the same group of photos shows high-order harmonic distortion being produced with very little intermodulation distortion.

Intermodulation measurements are generally recognized as a sensitive measurement of nonlinearity and may be made with slight difficulty through the use of an oscilloscope and simple associated equipment. A schematic is shown illustrating one setup used by the author. Sixty cycle frequency is obtained from the tube filament supply for the low-frequency component, and a simple audio oscillator using an old audio transformer is used to obtain a frequency of about 3000 c.p.s. for the high-frequency component. A vacuum tube mixer is used, although it is not necessary, and the output is applied to the input of the equipment under test. The output of the amplifier is then applied to the



Power supplies are an important design consideration in equipment where appreciable output is desired. Poor voltage regulation and insufficient decoupling appear to be two of the most important factors. Poor regulation means not only a reduction in sine-wave power output but also the introduction of a form of actual volume compression at the higher output levels. This form of distortion may be aggravated by the complex and intermittent waveforms found in speech and music and in one observed instance led to a seventy-

[illegible]

press transient waveforms of high intensity. Resistance-capacitance filters are one of the worst sources of poor voltage regulation and may be commonly used in the screen-grid circuits  
(Continued on page 153)



# A C.W. FILTER

By

**G. L. COUNTRYMAN**  
W1RHK, W3HH

Comdr., USN, Electronics Officer  
Naval Shipyard, Boston, Mass.

***An all-pass c.w. filter that will reject an interfering signal or amplify a desired one, without any receiver retuning. Bring that hard-to-get DX out into the open.***

**T**WENTY-FIVE years ago the new superheterodyne circuit solved most of the amateur's problems as far as receivers were concerned. Since that time, the available bands have been narrowed, and the number of amateurs using them has increased several hundred percent. The transmitting end of our business has made steady progress. Sharpness and stability undreamed of a decade ago are easily attained in even the simplest rig for the beginning ham.

What has happened in the receiver field? Few basic improvements have been forthcoming since the superheterodyne circuit. One was the crystal filter with improvements in design from time to time. Stability has been improved through the use of voltage regulators and temperature compensation, and more recently the "Q-5er" and other double conversion ideas have been presented. This double conversion has been a boon to the phone man but not of much practical help to the c.w. ham.

The idea, abandoned years ago, of using peaked audio circuits made its reappearance a couple of years ago. Initially the scheme was to sharply peak a desired signal using specially constructed chokes available on the surplus market at attractive prices. A twin-T bridge arrangement to peak the signal did away with the need for special chokes and was of about the same effectiveness. These ideas are good as far as they go, but a sharply peaked note devoid of harmonics is monotonous and very tiring to copy. The author presented a "QRM eliminator"<sup>1</sup> that has found fairly wide acceptance. This device may be used

for peaking at an established frequency, and then eliminating an interfering signal, and for short-circuiting an interfering signal that is louder than the signal you want to copy. It is flexible, making possible several combinations of circuits by the throw of a switch.

Current IRE proceedings papers have been noted, and a recent article<sup>2</sup> discussing a new phase-inverter connection with an all-pass RC filter has been studied with interest. The c.w. filter to be described adapts these newest developments to ham requirements.

The all-pass filter is used as a selective amplifier for either accepting or rejecting any particular frequency, and the frequency that you can accept or reject is determined by turning a single knob. No longer do you have to carefully tune the receiver to bring an unwanted signal up to a pitch of 1020 c.p.s. in order to reject it; just turn the knob and at the proper point the interfering signal will fade away. Conversely if your particular head-set has a high response peak at say 800 c.p.s., a turn of a knob will bring the desired signal up to a high peak at the frequency you wish.

The filter is compact. The power requirements are so low that the average receiver power supply will furnish them, and, in addition, the circuit has the advantage of being practically fool-proof. It possesses many advantages over the conventional bridge circuits; it has a very sharp rejection slot, sharper than many receiver crys-

1. "QRM" June 1949  
2. "Tunable A.F. Amplifier," Villard, "ELECTRONICS," July 1949



A metal box, 3" x 4" x 5",  
mounts all components.

tal circuits, and both null and oscillation occur at the same frequency for any given setting of the control. It can be used alone plugged into the output of the receiver with or without the crystal filter of the receiver. It can be utilized in conjunction with the surplus FL8 type of audio filter which most hams have acquired, and if desired it may be used as an audio signal source continuously variable from about 300 to about 9000 c.p.s.

Referring to the photographs, the bottom knob is the frequency control and is a dual 500,000 ohm potentiometer ( $R_1$  and  $R_2$  on the wiring diagram). The top knob is the selectivity control. The switch ( $S_1$ ) is a double-pole, double-throw toggle switch, one position providing selective amplification at the frequency desired. In the other position, frequency rejection is accomplished at the same frequency, as determined by the bottom knob. As the selectivity control is advanced from the "broad" position, the unit will oscillate at about the point shown by the knob pointer in the photograph. Up to the audible oscillation point the selectivity becomes progressively greater, until just before oscillation it is so sharp as to be impractical to use. The important point is that it is adjustable continuously with smooth control.

All you phone men can stop reading now. The unit can be used on phone, yes, but only to eliminate heterodyne whistles. As indicated by the title, it is primarily a c.w. man's filter to re-



ject an interfering signal or amplify a desired signal more than the others with minimum effort and, what is important, without any receiver retuning which might lose that choice DX you are trying to bring out into the open.

Now let's scan the wiring diagram. It looks simple enough, and it is, if you build it on a fairly large chassis. No special wiring precautions are necessary. The author wanted the filter to fit into the smallest practicable space, so it was constructed in a 3"x4"x5" metal box. A surgeon experienced in tying sutures in a small incision should be able to wire it up without difficulty. The practical way is to first wire up the sockets, including necessary leads, to the other socket and to components (and the 6.3 volt tie point) and then put the sockets in place. Internal wiring will be easier if the front socket is placed in position first and all possible interior wiring completed before mounting the rear socket. Even with this procedure the soldering is a bit tricky using the substantial iron usually found in the average ham shack. Of course, both sides of the metal box are removed, and in any event a couple of evenings are enough to do the job. Check the socket wiring carefully before installing them and connect wire resistors and ground connections to soldering lugs so that you can slip the lugs on the screws when you fasten down the sockets.

The wiring diagram is easy to follow, and no further comments are necessary. As to components, there are four items that are "fussy." The entire success of the operation will depend on how well the plate resistor and the cathode resistor in each section of the first 6SL7 are matched. Although 1000 ohm resistors are available, you can't just buy two "silver band" 1000 ohm resistors and put them in. These two resistors must have *exactly* the same value, which may be slightly over or slightly under 1000 ohms, but they must be matched and hence must be measured on an accurate bridge. Ohmmeter measurements are not of sufficient accuracy in this application. For long time stability, precision resistors should be used although in the model shown the regular 10 per-cent tolerance is used. It was necessary to check fifteen or twenty individual resistors before two were found that were exact pairs. Bear in mind that the resistance of a carbon unit will vary with the current passed through it.

The same procedure is necessary for the 2000 ohm resistors in the second plate and cathode section of the first 6SL7. Values usually available are 1800 ohms or 2200 ohms. Any value between these limits will be satisfactory, but it is mandatory that both resistors be of exactly the same value.

Standard audio tapers are satisfactory on both potentiometers. With the dual 500,000 ohm unit, it is necessary that both pots track at the same resistance reading. On several "run-of-

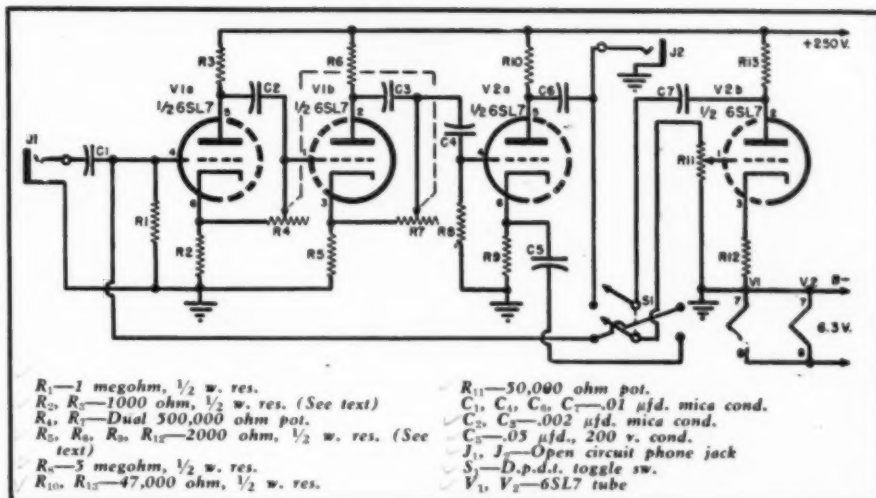


Diagram of c.w. filter. A separate power supply (250 v., 8 ma.) is required.

the-mill" pots that were measured the tracking was adequate so no difficulty should be experienced.

Many modern receivers have a "utility" outlet from which 6.3 volts a.c. and approximately 250 volts d.c. are available. The two 6SL7s draw only .6 amps at 6.3 volts, and at 240 volts the total plate current drain is only about 8 mls. Practically every receiver can supply this without the power supply overheating or without a voltage drop. If your receiver does not have a utility outlet it is easy to bring out the necessary leads. A small power supply can be built if desired; one consisting of a 6.3 volt transformer with two selenium rectifiers in a voltage doubling circuit will do the trick. A conventional, small transformer type power supply may be used without worrying about which side of the a.c. line is grounded.

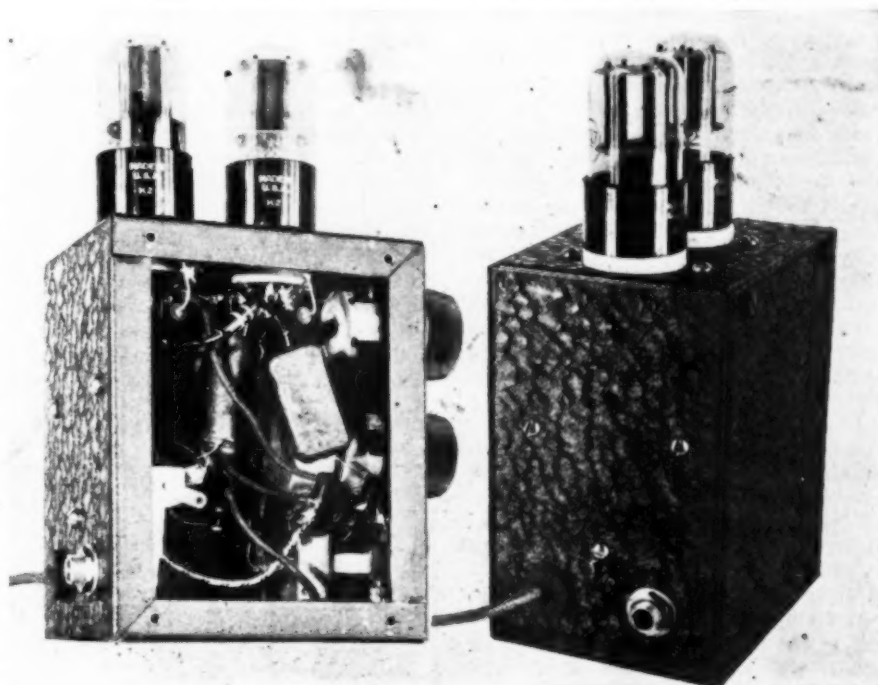
Considerable variation in tubes has

been noted. Some 6SL7s that tested as satisfactory in a tube tester did not give the same results as other tubes. Plate voltage is not critical within wide limits. From 200 to 250 volts will be satisfactory.

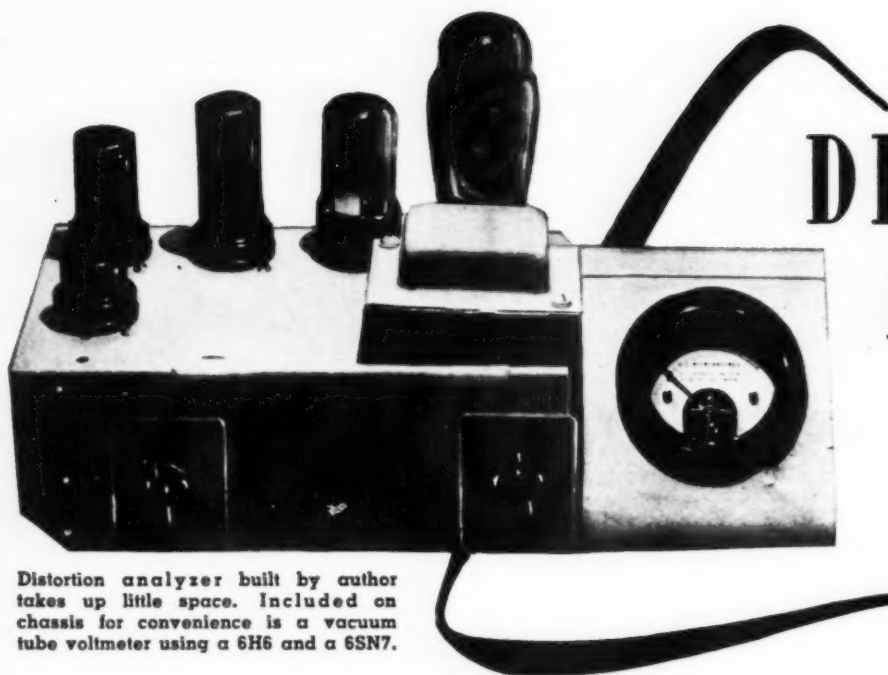
Again referring to the photographs, the jack at the back of the unit receives a patch panel cord, the other end of which plugs into the phone jack on the receiver. The headset plugs into the jack on the front of the filter. That's all there is to it; get the voltages to the unit, insert it between your receiver and your headset, and start turning knobs. Select a signal, peak it up sharply, and then throw the switch and hear it disappear. The filter is simple and effective for either peaking and amplifying or for rejecting a signal without having to adjust the pitch of the signal with the receiver.

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Side panel is removed to show details of internal wiring and assembly.







Distortion analyzer built by author takes up little space. Included on chassis for convenience is a vacuum tube voltmeter using a 6H6 and a 6SN7.

# A Simple DISTORTION ANALYZER

By  
**MICHAEL WOLFE**

***Distortion in any amplifier can be checked with this test analyzer. An audio oscillator and an oscilloscope make up the balance of equipment.***

**A**NYONE interested in constructing a distortion analyzer a fairly well-known fact that the hearing tastes of individuals differ widely. The average enthusiast builds an amplifier and judges it on whether it sounds all right or not. This is all very well and good if he is going to use it for his own enjoyment, but if he is building it for someone else, there must be more rigid criteria of performance, the usual technical standards being frequency response, percentage of harmonic distortion, and, more recently, the percentage of intermodulation distortion.

An audio-frequency signal generator and an a.c. voltmeter will suffice for the first measurement, but to measure distortion it will be necessary to employ either a wave analyzer or a distortion analyzer. Commercial wave analyzers are complex devices costing in the neighborhood of several hundred dollars, while a simple distortion analyzer may be constructed with little expense and, in conjunction with an oscilloscope, will prove to be a very versatile instrument.

The theory of operation of the distortion analyzer is quite simple. A reference signal from an audio oscillator is fed into the input of the amplifier being tested. The output of the amplifier is shifted to 180 degrees out-of-phase with the original signal and then electronically mixed with a portion of the reference signal. The two signals 180 degrees out-of-phase will cancel each other out if they are of

the same amplitude, and if the amplifier under test has not introduced any distortion. Any distortion caused by the amplifier will remain, however, when the fundamental is cancelled out. These distortion products may then be easily seen on the screen of a cathode-ray oscilloscope and classified as to harmonic distortion, improper bias, or over-excitation.

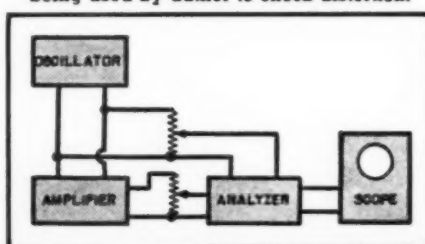
The unit built by the author consists of a 6N7 electronic mixer with cathode follower output (Fig. 2) to minimize distortion in the mixer stage, and a 6J5 distortion products amplifier. A block diagram of a typical test setup is shown in Fig. 1. The audio oscillator may be one of the Wien bridge type such as was described in the November, 1946, *RADIO NEWS*. It is highly desirable to use an oscilloscope to observe the output of the distortion analyzer, as this will increase its usefulness by indicating the kind as well as percentage of distortion in the output. If a scope is not available, however, an a.c. voltmeter may be placed across the output. To determine distortion percent-

age, the amplifier input is disconnected, and the reference signal input is adjusted to give 100 per-cent deflection on the output meter or scope. The amplifier input is then connected and the potentiometer adjusted to give minimum deflection. The meter or scope may then be read directly in terms of distortion percentage.

The reference signal type of distortion analyzer is somewhat more flexible than the bridged-T type of distortion meter, as it permits the testing of various frequencies throughout the audio range. It is, however, sensitive to phase shift in the equipment under test, and corrective networks may be needed to give accurate results. If the reference signal and the signal being tested are in phase, an increase in meter reading will take place when an attempt is made to balance the circuit. If 90 degrees phase shift is present, no change in meter reading will be noticed until one of the signals becomes greater than the other. Phase shift of a few degrees will cause erroneous distortion readings.

Phase shift is held to low proportions in the analyzer unit due to the use of twin triodes and cathode follower output; however, it is desirable to provide some means of compensating for phase changes in the equipment under test. Fig. 4 illustrates several simple circuits. Push-pull output on the audio signal generator provides an easy means of changing the phase of the reference signal 180 degrees for use with amplifiers whose output may be in phase with the input. B and C are phase shifting networks, similar to ordinary tone controls, that may be used to obtain exact 180 degree phase relations. These networks should preferably be used in connection with the reference signal as the tone control effect may tend to suppress or accentuate distortion.

Fig. 1. Block diagram shows test setup being used by author to check distortion.





tion components from the amplifier under test.

Phase distortion may easily be determined through use of an oscilloscope. The reference signal is applied to one set of deflection plates, and the output of the amplifier under test to the other set. Phase shift other than the desired 180 degrees will produce an oval pattern on the screen. The phase shifting network may then be adjusted until a slanted line results. If harmonic distortion is present in the amplifier, irregularities in the line may be observed, and this can be used as a simple means of locating distortion in an amplifier. Once the phase adjustment is made for a particular frequency, the distortion analyzer may be balanced for minimum meter reading and the harmonic distortion percentage read directly. If a scope is unavailable, an alternate procedure is to set the amplifier output to a low value where, presumably, distortion products are not very great and then adjust the phasing control for minimum reading. As the phasing and amplitude controls are somewhat interdependent, this will usually require a series of adjustments.

In most instances amplifier phase shift will be most pronounced at very high and very low frequencies. In the former case, shunt capacities are usually the cause, while at low frequencies insufficiently large coupling condensers will cause phase shift. Similarly, poor output transformers and tone controls are common locations of phase distortion. As effective use of inverse feedback usually depends upon exact phase relations, it is usually a good policy to explore amplifier phase characteristics at various frequencies. In this manner it is sometimes possible to insert phase compensation in the feedback loop and secure higher feedback ratios than are otherwise obtainable. Likewise, although for many years phase distortion has been considered of little importance, recent studies indicate that it may have a definite effect upon the quality of reproduction.

Although the ability of the distortion analyzer to compare the output of an amplifier directly to the input means that a perfect sine wave signal source is not necessary, it is undesirable to use a signal source with a high harmonic content, as a non-linear frequency response in the amplifier under test may give incorrect readings. An example of this is shown in Fig. 3.

In making distortion checks, it is a common practice to measure distortion at various power levels and at various points throughout the audio range. Distortion due to noise or hum may be relatively high at very low power levels, decrease at moderate power levels, and increase again as the maximum power output is approached. Distortion checks at various frequencies may show a considerable variation in power output at a constant percentage of distortion.

A seldom mentioned characteristic is sometimes found in amplifiers where hum reduction is achieved by use of a push-pull circuit. In this case, the circuit tends to act somewhat like a balanced modulator and superimpose hum modulation upon a reproduced signal. This may result in unpleasant quality and apparent high distortion percentages in the low frequency response. The solution is, of course, better filtering rather than a new output transformer. A simple test is to observe the hum level with one of the output tubes removed. If hum is very noticeable, additional filtering may be required. In a like manner it is sometimes desirable to check the distortion characteristics of a push-pull amplifier with one of the output tubes removed, as this gives a rough approximation of intermodulation tests used to determine the complex wave characteristics of a unit. In a poor amplifier, power output may fall off greatly, accompanied by considerable distortion in the high and low frequencies. Similarly, the frequency response may be greatly altered.

The unit diagrammed in Fig. 2 was designed primarily for simplicity of construction for those who may have only occasional use for distortion measurements. The experimenter or custom builder who has constant use for a device of this kind would be advised to build a more elaborate unit including a built-in vacuum tube voltmeter and incorporating the phasing networks shown in Fig. 4. For convenience in securing accurate adjustments, two potentiometers may be used at the reference signal input to the distortion analyzer, with the output of one control being fed to the input of the other. This allows one control to be used for coarse balancing and the other for fine balancing adjustments. A similar arrangement may be used in connection with the phasing controls, and this type of operation is usually found in commercial distortion meters of this kind.

A vacuum tube voltmeter is to be preferred in reading the output of the analyzer but if unavailable, an oscilloscope with a calibrated screen may be used. It should be noted that although the circuit diagram in Fig. 2 shows direct coupling between the cathode of the 6N7 and the grid of the 6J5 it is important that the cathode voltage of the 6J5 be at least two

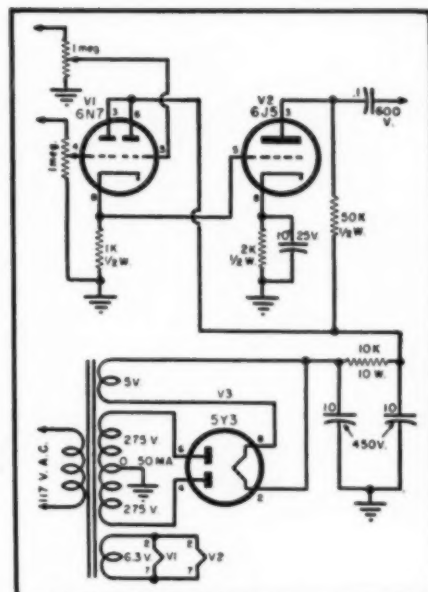


Fig. 2. Diagram of distortion analyzer.

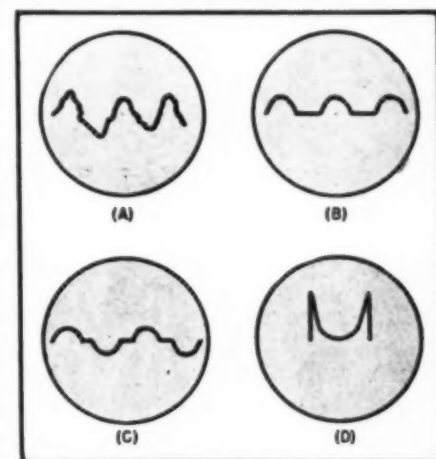


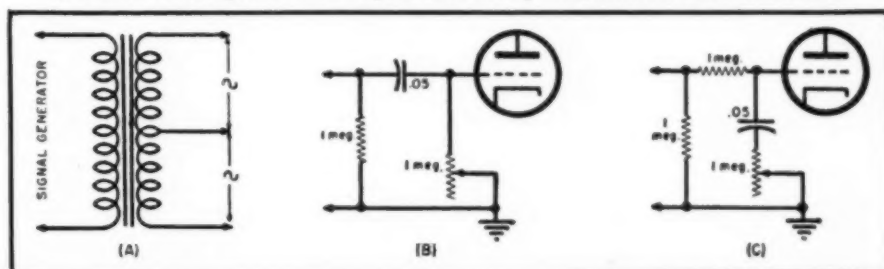
Fig. 3. Various types of distortion as viewed on a scope. (A) Harmonic distortion; (B) improper bias; (C) over-excitation; and (D) result of passing a square wave through an amplifier with limited frequency response.

volts higher than that of the 6N7 in order to produce proper bias.

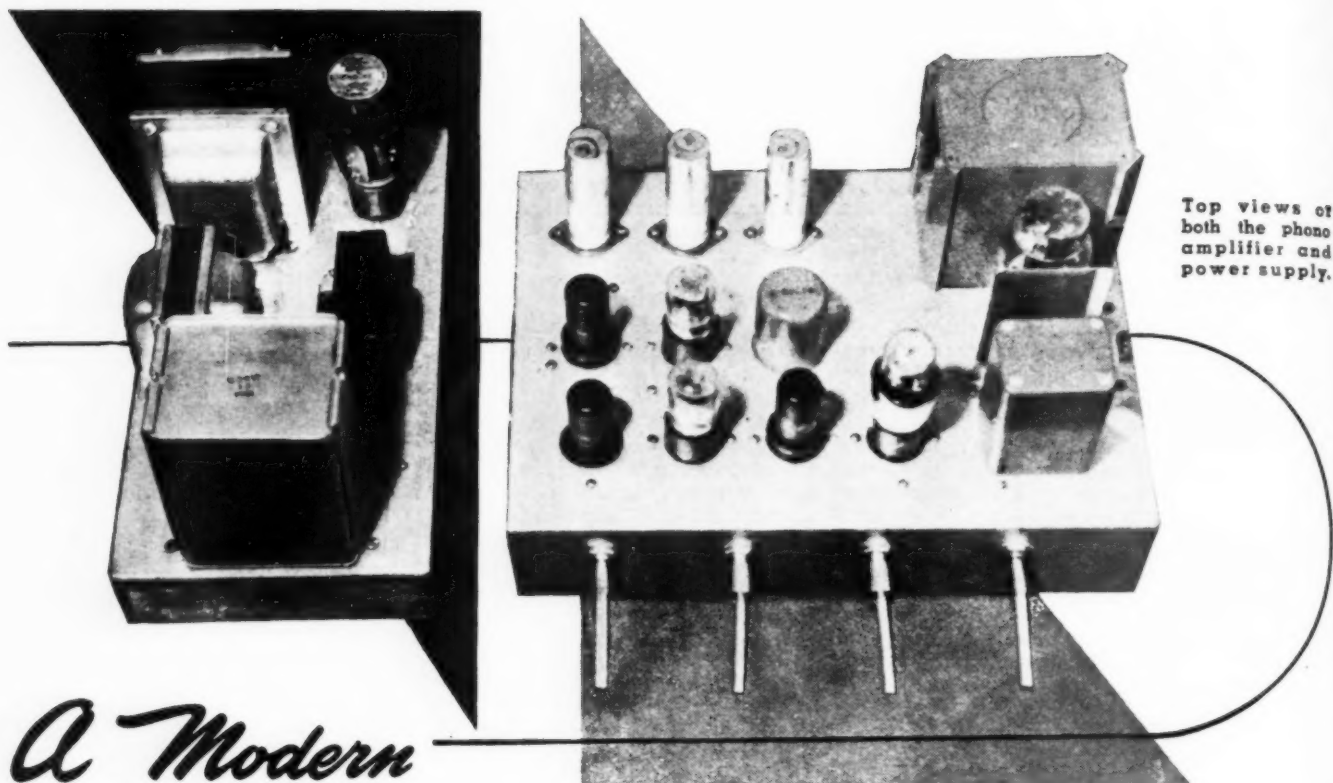
In measuring small amounts of distortion, considerable care should be taken in the construction of the analyzer. A good way to check the accuracy of the analyzer is to invert the reference signal 180 degrees and feed it into the other input of the analyzer; if you can then obtain a zero reading,

(Continued on page 173)

Fig. 4. (A) Means of obtaining two voltages 180 degrees out-of-phase from your signal generator. (B and C) Method for correcting for either leading or lagging phase shift. Values shown will allow a considerable amount of phase variation over a range of from 50 to 500 cycles, which may be extended by using different values of R and C.







Top views of both the phono amplifier and power supply.

# A Modern Wide-Range PHONO AMPLIFIER

By **CHARLES S. MAYEDA**

Radio Dept., Northwest Airlines

***A well-designed audio amplifier, featuring a simplified dynamic noise suppressor and Thordarson bass and treble tone control circuits***

**T**HE amplifier and power supply unit to be described here was designed to fit the requirements of a custom-built cabinet, the power output being sufficient for home living room use. It possesses a flat response from 20 to beyond 15,000 cycles, as well as flexibility in altering this response characteristic in the form of bass and treble tone controls. Some form of scratch suppression for phono use was also judged desirable.

For average home living room use, 10 watts of output power was considered more than sufficient. This allows for the use of triodes without resorting to parallel operation or the need for inverse feedback of beam power tubes. The many advantages of the 6AS7G dual triode have been well covered in previous issues, so this article will limit the discussion to design consideration for this particular ampli-

fier. It was decided to operate the tube at approximately 200 volts plate-to-cathode, increasing the bias 10 volts over published data to 100 volts, reducing plate dissipation to below rating. With these voltages, grid-to-grid voltage swing requirements are approximately 200 volts peak, to drive the tube to rated output. The drive requirements are rather large in comparison with other output tubes; however, these can be met without going into special circuits or other devices. While a push-pull amplifier would be ideal to secure the required grid voltage swing, the grids of this stage would necessarily be also driven in push-pull relationship, which would require an additional expensive transformer or the necessity of resorting to some form of phase inversion.

Looking over data for voltage amplifiers, the 76 type tube is rated

among the low mu triodes as having the greatest output voltage capabilities; with a 300 volt plate supply, rated output varies from around 70 to over 100 volts peak output, depending on load conditions. With an input transformer turns ratio of 2.5 to 1 over-all, this tube is capable of supplying the required driving voltage. To allow for some reserve, it was decided to increase the plate supply voltage to 350 volts. Plate supply may be further increased without exceeding plate voltage rating. The 76 tube, while an older version of the low mu triode, serves excellently the requirements of this amplifier.

The 76 voltage amplifier is preceded by a 6J5 used for tone control purposes, and Thordarson units are used. Briefly the operation is as follows. The cathode resistor is of high value and unbypassed, causing degeneration of all frequencies. Introducing the choke into the cathode circuit results in a low impedance path for the lower frequencies. This same choke is introduced into the grid circuit of the following tube, resulting in shunting of the lower frequencies. A low value condenser introduced into the cathode circuit by the tone control results in a low impedance path for the higher frequencies, thereby causing treble boost. The same condenser is shunted across the grid of the following tube on the other extreme of the tone control, resulting in treble attenuation.

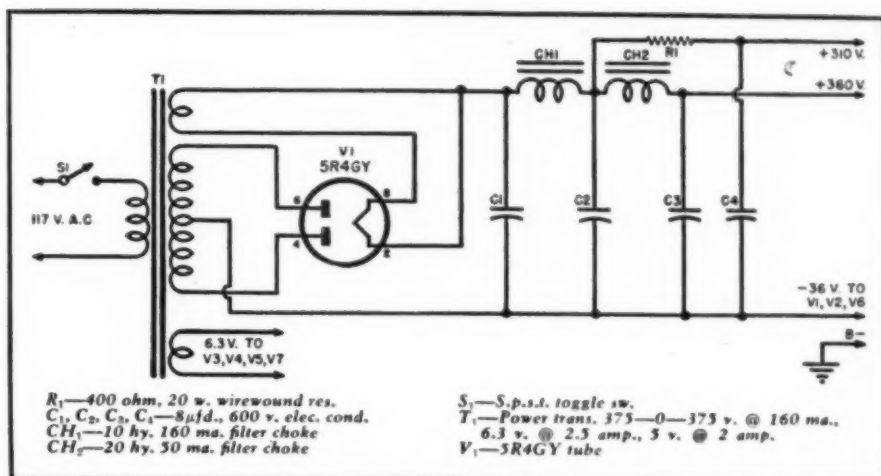
In order to reduce hum output to an absolute minimum, it was decided to run the heaters of the low level stages on d.c. This consideration dictated the choice of a 150 milliamper heater, a low mu triode, and a 12AH7GT for the equalizer amplifier,



as well as for the tuner amplifier. The plates are tied together, and the grids are separated, one for the tuner and the other for phono use where the volume control is introduced. This stage provides about 20 db. gain. Approximately one volt tuner output is more than sufficient to drive the amplifier to full output.

The phono equalizer uses a 12SC7, this circuit having appeared in previous publications. Resistor and condenser values are such as to provide a cross-over point around 500 cycles with the 6 db. de-emphasis occurring around 1500 cycles. The choice of condenser  $C_{12}$  will determine where bass boosting will begin. A larger value will result in a lower frequency cross-over point. Condenser  $C_{13}$  determines the point where de-emphasis occurs.

To offer something better than a standard RC filter shunted across the pickup for scratch suppression, the simplified dynamic noise suppressor designed by C. G. McProud, and which appeared in the August, 1948, "Audio Engineering," was incorporated in this amplifier. The 6SL7GT serves as a side amplifier, and the 12SG7 is the capacity reactance tube shunting the pickup. Briefly, operation of the cir-



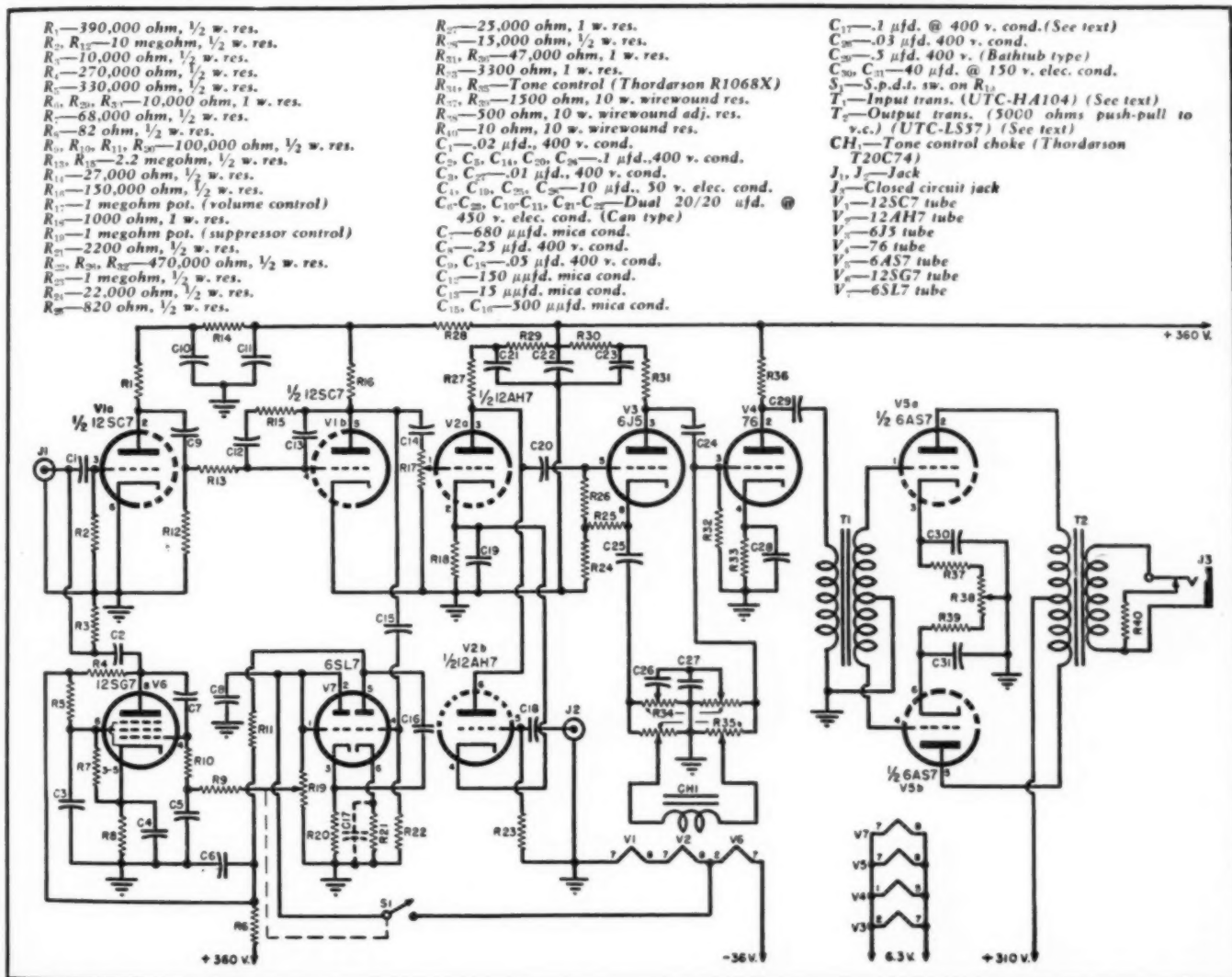
Wiring diagram of power supply. Unit is built on separate chassis.

cuit is as follows. The circuit components are of such value that maximum gain results on frequencies above 500 cycles. The rectified components of the signal are introduced into the grid of the reactance tube through the adjustable suppression control; on signals having higher frequencies the grid is driven negative, thereby re-

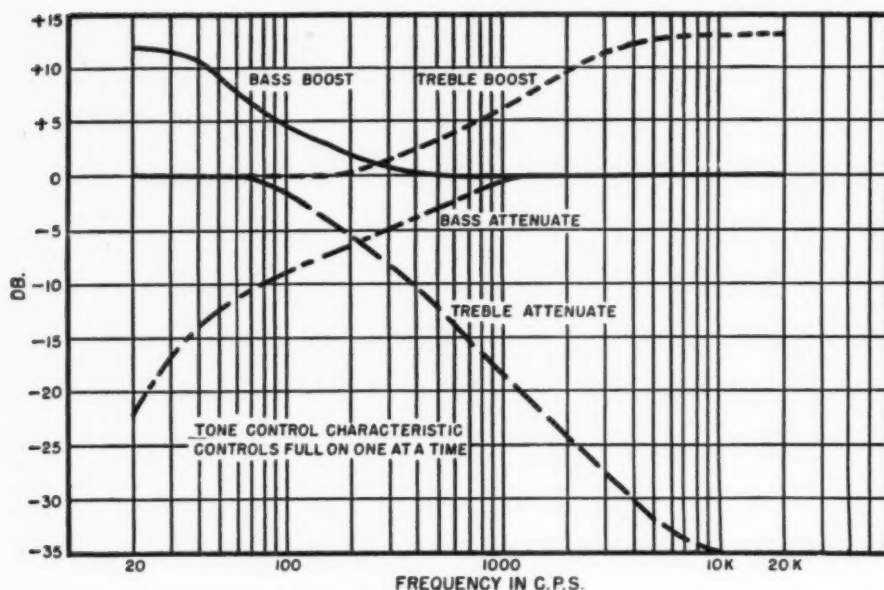
ducing the gain of the reactance tube, which in effect reduces the capacitance shunting the pickup. As mentioned in McProud's article, the circuit is effective only with a magnetic cartridge offering relatively sharp cut-off above a certain frequency.

In an amplifier of this type, where the output level is constant even down

Complete schematic diagram of the wide-range phono amplifier. Both phono and radio inputs are provided.







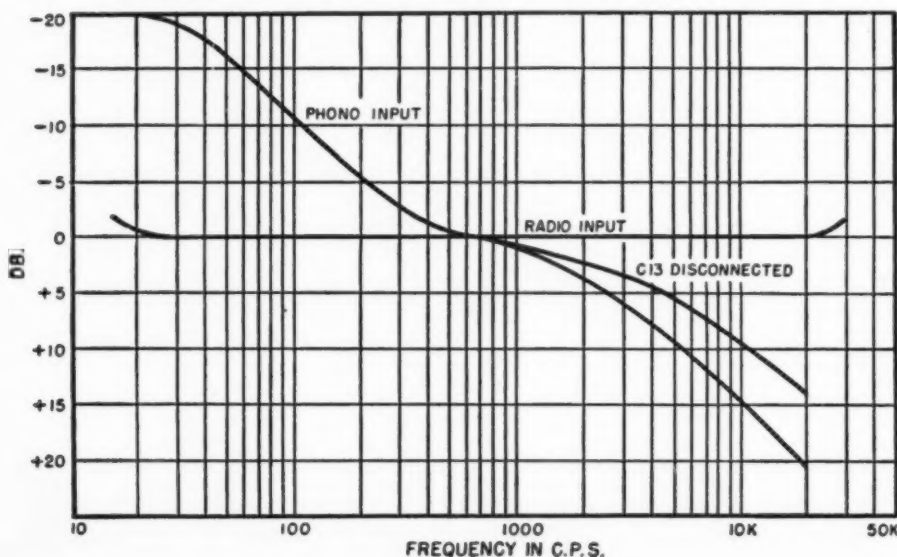
Tone control characteristics with controls full on, one at a time.

to a few cycles, and where the combined bass boost of the tone control and the equalizer stages are included, the sensitivity at the phono input terminals will run as high as a few microvolts at a.c. line frequency. Care must be exercised to avoid hum pickup. The high gain at low frequencies will also easily lead to motorboating. In this amplifier, large decoupling condensers with decoupling resistors are used in each plate supply lead. In the low level stages, miniature components are used together with as short exposed leads as possible to reduce electrostatic surface to minimum. Excessive shielding must be avoided to prevent attenuation of the higher frequencies. Chassis ground is made at one point only. Decoupling condenser cans should be insulated from the chassis, though they are at ground potential, to avoid ground loops. A separate chassis for the power supply simplifies hum reduction.

As the photographs will show, the

tube sockets were mounted primarily for the shortest possible leads, which also resulted in a relatively neat layout. Beginning from the left front row is the 12SC7 equalizer followed by the 12AH7GT; next is the 6J5 tone control stage feeding the 76 voltage amplifier to the input transformer and to the 6AS7G output tube. In the second row on the left is the 12SG7 reactance tube followed by the 6SL7GT side amplifier. Tube sockets were positioned to favor short leads for the grid and plate. The 12SC7 input tube is mounted on a 2 by 3 inch plate, together with all the associated components. This plate in turn is mounted to the chassis spaced by rubber grommets, effectively protected from mechanical shocks or vibration. The controls are as follows: Beginning from the left is the phono volume control followed by the bass and treble tone controls; the last control is for suppression, controlling d.c. voltage only. The actual wiring of the various

Response curve with tone control in mid-position and suppressor off.



controls is not critical. Position leads for best appearance.

Grid and plate coupling condensers were mounted by wrapping them with a thin aluminum sheet, forming brackets. Placement of the tone control choke was not critical due to the fact that the power transformer was separated from the chassis. The leads were, however, shielded. All a.c. filament leads are also shielded. The output transformer provides for two impedances (3000 and 5000 ohm) with a variety of low impedance voice coil outputs. The 5000 to 10 ohm connections were utilized. With an 8 ohm voice coil connected to the 10 ohm tap, the reflected impedance is reduced to 4000 ohms which is about the recommended value as published by the tube manufacturers for this particular set of plate and bias voltages.

The amplifier is mounted vertically in the cabinet. Input and output connections are on the side. Short leads dictate the position of the input jacks. The metal plate visible in the photograph between the output tube and the input transformer is added for heat baffling when the amplifier is mounted in a vertical position to avoid heating the input transformer.

The power supply needs little comment. The four 8  $\mu$ fd., 600 volt oil-filled condenser blocks were available from surplus. Any combination resulting in equal capacity and voltage rating will do. The voltage for the heaters is adequately filtered by returning all of the filter condensers to the center tap of the transformer. Bypassing on the other side of the heater string is effected by the six 20  $\mu$ fd. decoupling condensers of the amplifier. Voltage is taken from the first choke and dropped through the resistor to the proper value for the output tube. This is sufficient filtering for the output tube and avoids the necessity of a second high-current choke. Power-switching arrangement is not shown on the diagram as this will depend on the builder's choice. For this unit, two sockets were mounted on the power supply: one feeds power and allows for the "On-Off" switch on the turn-table proper; the other goes to the FM tuner, the volume control being mounted on the tuner.

### Tests and Results

The final value for plate voltage using the particular components for the power supply is 360 volts for the voltage amplifier. This same voltage feeds all the other tubes except the 6AS7G output. This is a bit higher than standard but does not exceed any of the tube ratings. The voltage to ground at the center tap of the output transformer is 310 volts; on each cathode of the 6AS7G it is 100 volts. With these voltage combinations, the total current drain is very close to the 150 milliamperes required for the series heaters. Actual measured drop was 35 volts. If any slight variation does occur, a bleeder can be added (Continued on page 131)



# An INTERCOM For The Home

By  
**R. G. FINKBEINER,\***  
WBAQK  
Engineer, WHRV

***This system provides master stations on each floor  
and any number of substations with a single amplifier.***

**I**NTERCOMMUNICATION systems have long proven their value in industry and business. Why haven't their time and labor saving merits been extended to home use? First, the cost of a flexible commercial installation would be excessively high owing to the use of separate amplifiers at each master station. Second, the value of a system in the home has not yet been realized because intercoms intended for such use, with reasonable flexibility, are not available. A flexible, low-cost intercommunication system for the home was the objective in mind when this unit was designed.

The installation to be described has three master stations, two substations, and one amplifier, arranged as shown in the block diagram. The amplifier input and output leads are run to each of the master stations, and, with proper switching, a flexible system is possible at low cost. Two-way conversations can be originated from any master station to any master or sub-station. Provisions are also included for listening to radio programs, picked up by the family receiver, on the master stations.

The amplifier is a three-stage, high-gain unit constructed on a 12"x7"x3" chassis. It has a maximum output of about three watts, which is more than adequate. The input and output impedances are both four ohms, the former being provided by a voice coil to grid transformer. A quick-heating circuit puts the amplifier into operation in about three seconds. During standby the control relay,  $RL_1$ , is open, and three volts are applied to

the tube heaters. In operation the relay is closed and the normal six volts are applied.

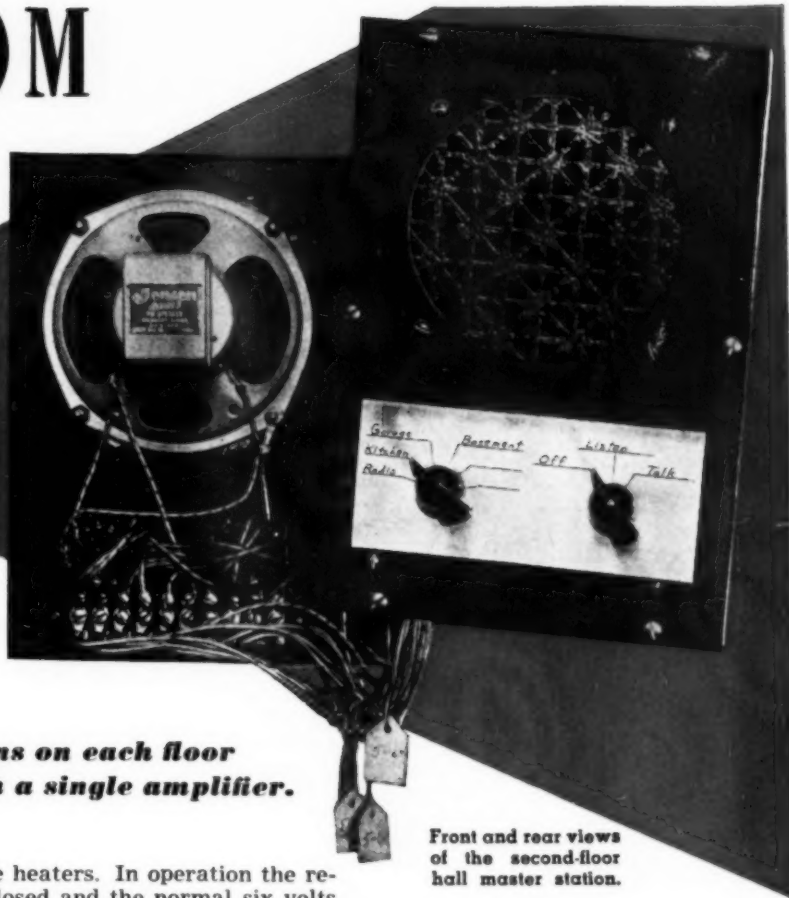
In an experimental version of this amplifier, two relays were used which gave a heating cycle of three volts standby, eight volts accelerated heating for about ten seconds, and six volts operating. The accelerated heating feature made no appreciable reduction in heating time and, therefore, was not included in the final version.

The relay used is a sealed plug-in unit with a coil resistance of 1800 ohms. Any s.p.d.t. plate circuit relay with a coil resistance of from 1500 to 2500 ohms can be used. D.c. is used on the relay to keep hum down and allows use of the ground leads from the master stations as relay returns, thus saving one cable conductor.

Of the several relay supplies tried, the selenium rectifier circuit shown is the most dependable. It provides an average relay current with the  $R_{10}$ ,  $R_{11}$  voltage divider shown. The a.c. circuit to the selenium rectifier is completed through the actual ground lead; therefore, the line plug must be inserted correctly for the relay supply to function.

Selenium rectifiers are not used in the amplifier power supply because the d.c. voltage across the filter condensers would rise to a very high value during standby, thus shortening their life. With a tube rectifier, about 70 volts appears across the condensers during standby, and rises to the normal 250 volts during operation.

\* Home address: 215 Crest Ave., Ann Arbor, Michigan.



Front and rear views  
of the second-floor  
hall master station.

Inverse feedback has been added to reduce distortion and improve frequency response. The signal appearing across the output transformer secondary is fed back to the 6SF5 cathode through  $R_6$ . The cathode resistor,  $R_6$ , must not be by-passed. It may be necessary to reverse the leads to the output transformer secondary for proper phasing of the feedback signal, which is indicated by a drop in amplification.

A piece of 2" pipe, flattened slightly by a few sledge hammer blows, is used to shield  $T_1$ , the voice coil to grid transformer. Two 6-32x1" screws, with the heads sawed off, are soldered to the pipe and used to secure it to the chassis. The transformer is soldered inside the shield by its mounting feet. Its position on the chassis is determined by listening for minimum hum while rotating the transformer in its shield.

To prevent hum from eddy currents induced in the chassis by the power transformer and choke, an insulated lead should be used to connect all of the ground points together. The lead is then connected to the chassis at only one point, the No. 1 pin on the octal inter-connecting socket. Note that the primary of the input transformer is left floating at the amplifier, but that one side is grounded at the kitchen box. This provides separate ground returns for the amplifier input and output circuits and prevents oscillation.

(Continued on page 51)







For convenience in servicing, connectors are used to plug the speaker system and a.c. line into the amplifier. Also, the volume control is recessed and screwdriver adjusted to prevent tampering. When finished, the amplifier is fitted with a dust cover and mounted on a shelf in the cellarway near the kitchen master.

The kitchen master station is the junction box for the leads from the amplifier and remaining stations, as is shown in the block diagram. The ground leads, "G," from all stations and the amplifier must connect at the common ground point in the kitchen unit. Otherwise the amplifier input and output ground returns will appear on a single conductor causing oscillation. The remaining leads may be run in any convenient manner, which in most cases will be to the kitchen master, as shown.

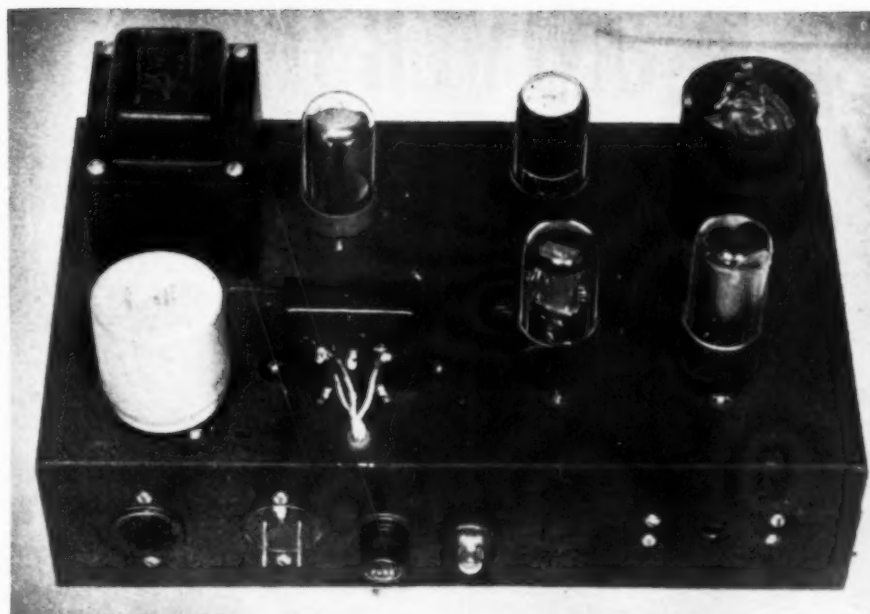
The master stations are built around 6"x9"x5" metal boxes. A box with removable sides is preferred for the kitchen master because of the large number of connections that must be made to the terminal strips in this box. The speaker, switches, and pilot light are mounted on the front, and the 10-lug terminal strip is on the inside bottom of the box. The 3-lug strip, used for line switch and pilot light connections, is placed on the back panel. Boxes with removable fronts are used for the upstairs and basement stations, and all parts are on these front panels. The dial plates are made from white cardboard stock and are protected with celluloid. The plates are lettered with india ink.

The selector switch ( $S_2$ ,  $S_3$ , or  $S_4$ ) connects the speaker of the station to be called to the common connection on the left-hand section of the "Talk-Listen" switch,  $S_1$ ,  $S_2$ , or  $S_3$ . This left-hand section then connects the selected station speaker to the amplifier input when listening, and to the output when talking. The right-hand section simultaneously connects the speaker of the station originating the call to the amplifier output when listening, and to the input when talking. The center section completes the relay circuit and puts the amplifier into operation.

The garage sub-station is a speaker mounted in a *Crisco* can, which makes a very efficient baffle. It is mounted inside the garage and covers the clothesline area back of the garage.

Radio programs may be heard over the master stations when the radio sub-station is connected to the voice-coil terminals of a radio. A bridging pad, consisting of  $R_{12}$ ,  $R_{13}$ , and  $R_{14}$ , reduces the voice coil signal level of the radio to that of the amplifier input. Transformer  $T_1$  is used for isolation of ground returns and impedance matching.

After the amplifier gain has been set, the radio is set at normal listening level, and then  $R_{14}$  is adjusted for the desired volume on the master stations. The 400 ohm value shown gives



Top view showing relative placement of above-chassis components.

normal volume with a radio which has a voice coil impedance of eight ohms. Slight deviations from this value may be necessary in some cases. The pad does not affect the normal performance of the radio. To prevent hum pickup, the matching transformer should be mounted away from any transformer fields. It may be placed anywhere between the radio and kitchen box, preferably near the radio.

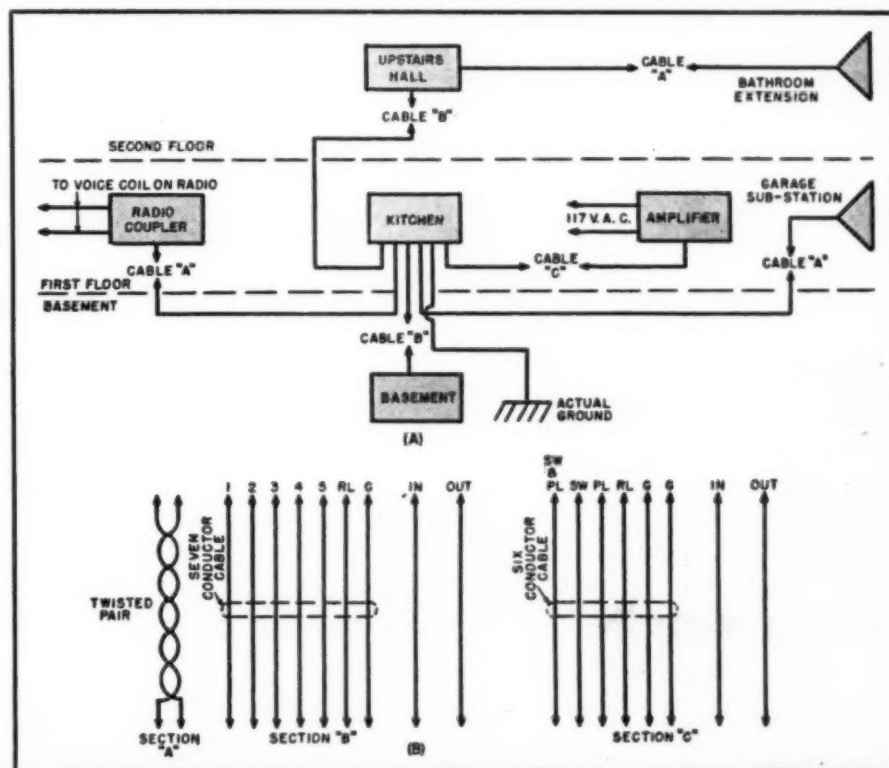
A second radio sub-station may be added, if desired, but only one radio can be heard at a time. It's strictly a one-channel affair. If a station listen-

ing to the radio is called, the call will come in with the program, but the answer will not be heard by the calling station. The called station must be turned "Off" first.

In installing the cable, the leads marked "In" and "Out" must be separated from each other and from the remaining leads, which may be cabled together, as shown on the cable diagram. Oscillation will take place if excessive capacitance exists between the input and output circuits of the amplifier. Physical separation of about an inch between cables running

(Continued on page 128)

Block diagram shows cable connections between the various units.





# A UNIVERSITY IS BORN



***Sidestepping academic subjects, this university specializes in a sound and audio course, leading to a bachelor's degree.***

Audio engineering student mixing a studio program at one of the modern instruments in the control room.

**O**NE of the most unique and unusual educational institutions of our time, the University of Hollywood was built around the theme of "sound and audio engineering." It is located in Hollywood, California, heart of the sound and audio industries, and surrounded by great motion picture studios, radio broadcasting stations and television telecasting stations.

Students receive their training in modern, well-equipped studios and laboratories. They work with the same types of equipment they will find on the job in motion picture, television, broadcasting, and recording studios.

In the recording studios of the school, which are as nearly acoustically perfect as a studio can be, the student spends many hours monitoring and mixing programs, and working with the live talent engaged in recording transcribed shows that will subsequently be broadcast over local AM and FM broadcasting stations.

Training is given in a completely-equipped audio transmission laboratory, where the student learns the purpose, use, and operation of such equipment as the gain set, the wave analyzer, the intermodulation analyzer, the distortion

set, the square wave generator, and the oscilloscope, to name only a few of the instruments, as well as all of the techniques required of the audio engineer in lining up recording channels, making gain runs, and allied transmission measurements.

In the shop, he learns not only how to make a properly soldered connection, but also the correct method of laying out an installation job and the techniques which go to make up a workmanlike job of constructing and installing various pieces of equipment, from a jack strip to a complete mixer console.

The radio and television laboratories of the university provide him with a basic theoretical and practical knowledge of radio and TV circuits so that he can handle any and all types of work in these allied fields of audio engineering.

The film laboratory provides training in the methods of recording sound on film or on magnetic tape; the operation, care, adjustment, and repair of magnetic recorders and optical systems; the use and operation of film dummies used for re-recording and dubbing of film; the prin-

Student performers and technicians study recording techniques in one of the university's several acoustically-treated studios.



In this completely equipped sound laboratory, students learn the professional techniques in studying disc recording mechanisms.





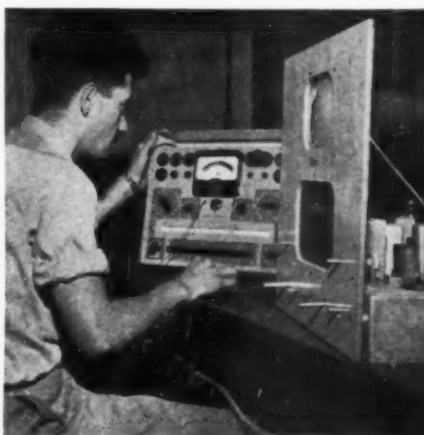
ciples of operation, care and, adjustment of film recorders; and the correct techniques of operation of various types of projection equipment, such as the student may be called upon to use until in a motion picture or television studio.

Future plans for the university call for designing and building one of the most modern sound stages in the world, where every type of recording project, large or small—from one-hundred-piece symphony orchestras to soloists and small dramatic groups—may be handled. These plans also call for the installation of a 12-position mixer panel, one of the largest types in existence, for which a minimum of three operators is required. This is similar to the type of mixing equipment which was specially designed and built for the recording of Walt Disney's "Fantasia," a production in which Dr. Tremaine (one of the co-founders), played a very important role as sound engineer in the design and installation of both the recording and reproducing equipment.

In conjunction with the radio broadcasting course, the university is planning to operate its own broadcasting station which will be staffed by advanced and graduate students of the broadcasting course. A television department with cameras and property and set construction classes is also to be added. This will provide training, in conjunction with the writing and drama departments, in all phases of telecasting productions, ranging from two-minute commercials to full major productions.

Dr. Klekner and Dr. Tremaine have appointed Dr. George K. Tefteau as Dean of the University of Hollywood. He comes well qualified for the past many years of experience in the educational and commercial world.

↓ No "mockups" are used at this new Hollywood University. All students are taught on the finest projectors and audio units available, learning how they are interconnected to make up a complete sound studio.



↑ Television sets are studied and analyzed by all engineering students.



↑ Students learn magnetic tape recordings on professional gear like this PT6 Magnecord. All forms of recorders, i.e., wire, tape, film, and disc types, are studied by all of the students.

→ Optical (film) and magnetic recording classes are given thorough training. Student is shown checking the density of the audio portion on a 35mm film recording.



★  
↓ Showing part of a maintenance lab where modern shop practices are taught all of the students.



↓ Fine points are not forgotten; observing ratio of land-to-groove on records. Disc recording is a major part of curriculum.



Dr. Tefteau holds degrees in law, business administration, the arts, and literature, and for the past 17 years he has been actively engaged in the educational field as an instructor in both universities and trade schools. In addition to announcing many radio programs which have been released over the major stations and networks, Dr. Tefteau has also had a hand in production and writing.

The idea of the University of Hollywood did not grow overnight. It involved years of searching and endless experimentation. It took the courage and the pioneer spirit of trail blazers for Drs. Klekner and Tremaine to formulate their plans and then see them through to fruition. Because of the strength of their convictions both of these men jointly endowed the university with a sum in excess of \$50,000.00.

All academic and non-technical subjects which do not contribute and are not applicable to the chosen engineering or professional career are being omitted. Because of the omission of these non-essential, time-wasting subjects, the University of Hollywood's streamlined education requires only eighteen months of training to qualify for a degree, a B.S.—Bachelor of Science in Audio Engineering.



# A HORN-TYPE TRANSDUCER of Minimum Dimensions

By **R. DOBY** and  
**G. AUGSPURGER, JR.**

Audio Research Labs.\*

**I**T IS a generally conceded fact that the relative efficiency of the direct radiator loudspeaker is low. All things being equal, the factor contributing most to this state of affairs is that the efficiency of such a speaker is relative to the area of its cone. This is especially true in the low-frequency region where the entire cone tends to act as a piston. The greater the area of the cone, the better the match between the driver mechanism and the air. This means that when more air is moved by the cone, the efficiency of the driver is greater, hence the emphasis on cone size.

For technical and practical reasons, direct radiator speakers are limited from attaining the ideal, i.e., from being able to move an air mass equal in square inches to one-quarter the wavelength of the lowest frequency to be reproduced.

A direct radiator loudspeaker, in order to reach optimum efficiency when reproducing a thirty-two c.p.s. signal, would require a cone diameter of approximately eight feet. It is obvious that the mass of such a cone precludes any practicality in its design. However, when the diaphragm of a driver unit is attached to an exponential horn, this ideal is easily met. For the horn is a mechanical-acoustical coupling device which transforms a low-velocity, high-pressure, acoustic energy at the entrance of the horn's narrow throat to a low-pressure, high-velocity energy at the termination of the horn's mouth, which is proportionately large in relation to the throat.<sup>1</sup>

There is available a considerable amount of literature regarding the theory of exponential horns, and it would serve no purpose to discuss further the technical nature of the

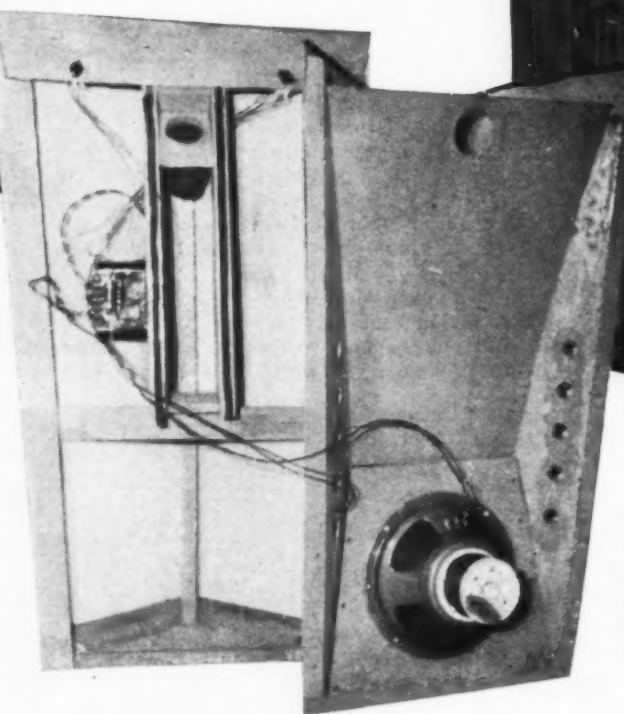


Fig. 1. The finished transducer. Over-all height of the unit is 41 inches. Note the back wave release ports and experimental dividing network in the rear view.

## *Constructional details for an integral space transducer for home or studio sound installation.*

subject here, except to say that by such a device air mass is substituted for cone mass. Since air is fluid and light, the great mouth areas of exponential horns offer no problem of mass, as would be the case in proportionately large cones.

Yet exponential horns have their disadvantages. In the first place, if they are to go down to the region of really low frequency response, they reach alarming dimensions, and their elephantine size limits their use to conditions where space is of little or no concern.

Secondly, they are somewhat directional in the middle frequencies and extremely so in the higher range. Lastly, they must be carefully designed in order that they will not have a discriminating effect against

the frequency response in certain given regions. This last problem is seldom met in horns of straight design, but it becomes of real consequence in folded or re-entrant type horns.

We have seen, therefore, that the horn-type speaker possesses many inherent advantages lacking in the direct radiator. Our problem then resolves itself around the development of a small portable speaker, using the principle of the exponential horn. At first this would seem to be virtually impossible, since (as we have seen) the horn depends for its effectiveness upon its cumbersome length and large mouth area. Shortening the horn will ordinarily generate standing waves and cancel out some of the very frequencies we are called upon to reproduce, giving rise to a most unsatisfactory over-all response.

Nevertheless, we will take an average  
(Continued on page 56)

\* Audio Research Laboratories, 1315 Tower Ave., Superior, Wisconsin.

<sup>1</sup> "Loudspeaker and Transformer Principles," Utah Radio Products Pamphlet—Page 5.



## DIRECTIONS FOR BUILDING AN INTEGRAL SPACE TRANSDUCER

THESE instructions are for a simplified horn having straight sides, but retaining all the characteristics of the tapered model shown in the accompanying photographs. The reasons for simplification are obvious when one considers that the tapered model has in its construction no piece which is not in some way beveled or biased to fit its adjoining member. The difficulty in constructing the tapered model without complete workshop equipment would be a formidable and time-consuming task. The straight-sided model will not tax the skill of the hobbyist nor the equipment of the home workshop, and the results will warrant the effort as well spent.

1—On a suitable piece of  $\frac{3}{4}$ " plywood stock, lay out the dimension given in Fig. A-1. This is basically a 45 degree isosceles triangle with 16" sides and another isosceles triangle of 30 degrees with the base of 23 $\frac{1}{2}$ " inches. The measurements shown in Fig. A-1 have been computed after cutouts for the side stretch Fig. C-3 have been made.

2—On  $\frac{3}{4}$ " plywood, lay out the dimensions given for Fig. C-3, the over-all width being 9" and the height 37". On the short base of this rectangle measure 8" from the long side left and drive a nail. Now find the midway point of the long side marked M in Fig. C-3. This is 18 $\frac{1}{2}$ " up from the short base. At this point measure from the long-side 7 $\frac{1}{4}$ " and drive a second nail. At the very edge of the long-side left, adjoining the short-side top, drive a third nail with a spline, i.e., a thin, elastic strip of wood or metal, 40 inches or more in length; place this behind the first nail in front of the second nail, and behind the third nail there is now produced a curve. Mark this curve with a pencil and withdraw the nail. This will be the inside of the curve for Fig. C-3. The curve should be sawed at a 45 degree angle, found by drawing a line from the bottom of this curve line to a point 9 inches on the bottom side, short base, far edge. The straight side of Fig. C-3 should have an included angle of 30 degrees to match the front side of Fig. A-1.

3—At a point  $\frac{3}{4}$ " up from the short base of Fig. C-3 draw a diagonal line 16" long, intersecting with the curved edge; along this, line cut of a  $\frac{1}{4}$ " slot  $\frac{1}{4}$ " deep, using a sharp small chisel or, if available, a circle saw equipped with  $\frac{1}{4}$ " dado head. When this piece, Fig. C-3, is finished, reverse all the angles and make another piece. This will give you the required two opposite struts.

4—On  $\frac{1}{4}$ " presdwood lay out the dimensions in Fig. B-2 and saw out, being sure that you keep the smooth side of the work facing you. Next reverse the measurements and lay out a like trapezoid. This will give you the two side pieces, one of which is shown as Fig. B-2. The smooth sides should be faced inward toward each other as they would be subject to view in the completed structure.

5—With the aid of  $\frac{1}{2}$ " wood screws and a liberal covering of glue attach the pieces C-3 to the smooth side of pieces B-2. The long 37" side of B-2 is the front side, and it is evident that C-3 will be fastened so that its straight edge corresponds to this length.

The slot in C-3 will face outward.

6—From your lumber yard secure a 32" piece of inside corner moulding (manufactured by the American Plywood Company). This must be able to accommodate  $\frac{3}{4}$ " stock. See Fig. D-4. Bore on 4" centers through the flanges on both sides of this moulding  $\frac{3}{16}$ " holes. When this is completed slip the pieces B-2 into the recess channel, mark the holes with a pencil, and bore with a  $\frac{1}{4}$ " drill. When you have finished, extract pieces B-2 and coat the edges which engage the moulding channel with liquid rubber. Reinsert the pieces B-2 into the channels and secure with  $\frac{1}{4}$ " flat-head stove bolts, placing the head on the outside of the channel. Cut off excess thread with a good wire clip.

7—With 1" wood screws and a liberal application of glue, attach the assembly of the two pieces C-3, the two pieces B-2,

and piece D-4 to the base A-1. This should fit accurately and should be fastened as firmly as possible.

8—On  $\frac{1}{4}$ " presdwood stock lay out the dimensions for Fig. E-5. The height, width of the base, and width of top are given. For the center measurement midway between base and top, measure at a like point the diagonal across the assembly as it stands in Step seven. This distance should be 14 $\frac{3}{4}$ ". Again drive nails, place the spline, draw the curve, and complete by sawing out. The circular hole located 4" on center from the top and mid center with the top of Fig. E-5 is for the University tweeter, mounting holes measured from the tweeter.

9—Take a piece of  $\frac{3}{4}$ " stock lumber 11 $\frac{1}{2}$ " long and 2" wide. Plane a beveled edge on the  $\frac{3}{4}$ " side to an angle of 40 degrees, and fasten with wood screws to Fig. E-5, 9 $\frac{1}{4}$ " above the mid base. This is shown in Fig. F-6. The flat 2" side to face inward against Fig. E-5 and the 40 degree bevel to face upward and away from the base.

10—Place Fig. E-5 and Fig. F-6 assembly into the triangular structure obtained at the completion of step seven. Fasten E-5 to the curved beveled edges of the side struts C-3 with  $\frac{1}{4}$ " wood screws, after having first coated the beveled edges of the side struts C-3 with liquid rubber.

11—On  $\frac{3}{4}$ " plywood stock lay out the dimensions given for the top, Fig. J-9. Fit the long side of the triangle of J-9 to the face of E-5, using glue and 1" wood screws.

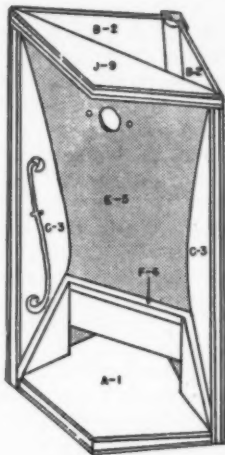
Assembly as it has thus far been completed should resemble the drawing in Plate Number 1, on which the figure numbers have been listed for each component, enabling the reader to better visualize the placement of the various parts.

12—On  $\frac{1}{4}$ " presdwood stock lay out the dimensions for Fig. H-7, and saw out. The speaker cut-out will depend on the size of the speaker being used, 9" being arbitrary; all speaker mounting holes are to be taken from the speaker itself. Place on the base A-1 a piece of wrinkled aluminum foil cut to fit. This should be glued to a felt base of the same dimensions, and in its turn glued to the base A-1. (Object: to break up reflected sound in the throat of the horn). Next slip speaker mounting baffle into the slot in side strut C-3. With  $\frac{1}{2}$ " wood screws fasten the 14" top of H-7 to the beveled edge of Fig. F-6.

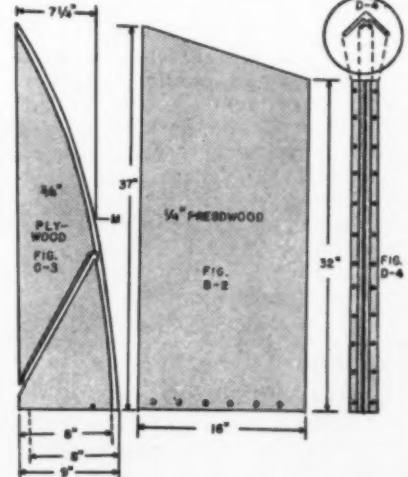
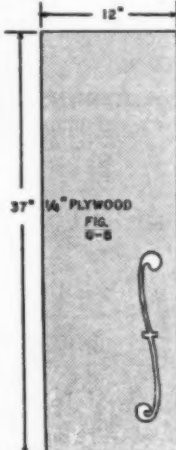
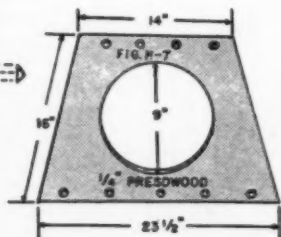
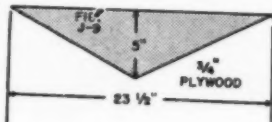
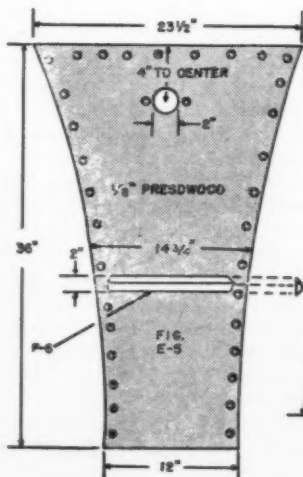
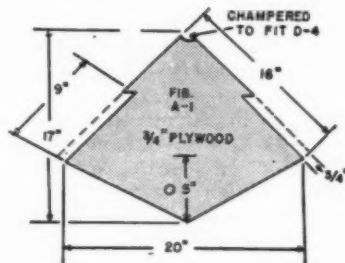
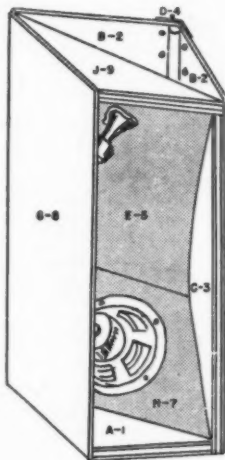
13—Mount speaker, the large cone bass driver on H-7, and the tweeter in front of the 2" hole in Fig. E-5. Assemble the high-pass filter as supplied by the manufacturer of the tweeter and bring the speaker feed cable through a hole in the base A-1 located under the bass speaker close to the front, the exact location being arbitrary.

14—On  $\frac{1}{4}$ " plywood with a mahogany or other suitable veneer on the finished side lay out the dimensions as shown for Fig. G-8. Cut two pieces to these specifications and angle the long sides that butt together in order to make a close-fitting joint. Fasten with oval-headed screws and finishing washers to the base A-1 and top J-9. Struts to reinforce the front panels G-8 are not shown, but it is evident what can be done to reinforce these pieces. F slots are also shown in Fig. G-8 to relieve back pressure for the bass speaker, but any configuration can be employed here as long as the area of the opening is equivalent to 8/10ths of the number of square inches in the speaker opening of Fig. H-7.

In conclusion, let us remind the prospective builder that the dimensions contained herein limit this corner baffle to a maximum speaker diameter of 12". Success depends upon careful workmanship, attention to details, and good shop practice. When completed in ship-shape fashion this horn baffle, using an RCA 10" accordion edge bass speaker and a University single tweeter, will open the way for high-quality sound at moderate cost. Thus far, we have not mentioned the dampening for the recess formed in the completed structure between E-5 and the front pieces G-8. For this purpose before the pieces G-8 are set in place, glue to the faces of E-5 and C-3 at least two thicknesses of Ozite floor matting, cut to fit. On the pieces G-8, glue one thickness of the same material, making sure you do not cover up the release ports for the back pressure set up by the bass speaker. The finish is left to the discretion of the builder.



(Plate 1)





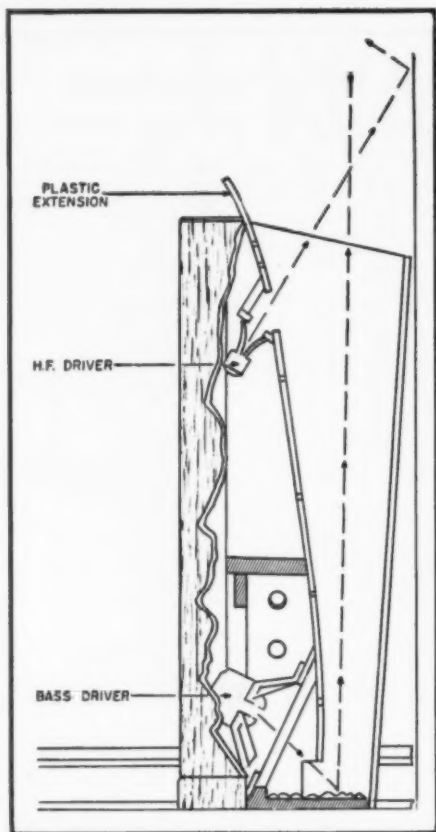


Fig. 2. Side view showing basic horn design.

age room and see what can be done to improvise a horn-type speaker that will not be of prohibitive size. Assuming that we want the best possible dispersion of sound and wish to take advantage of the greatest natural efficiency common to enclosed chambers, the best location for the transducer is unquestionably in the corner of our given room.

Let us then wall off a portion of this corner and bend the wall so that the enclosed space takes on the characteristic of an exponential expansion. If our horn is to have a low-frequency cut-off of about 48 cycles, the triangular area should double itself in cross section every 18 inches. So far so good, but how are we to introduce the mouth of the horn into the room? The best solution would be to design a coupling so that the air column would emerge tangent to the ceiling and to both walls. If we sketch this idea (Fig. 3) it becomes readily apparent that we have brought the whole room into play as a part of the loudspeaker system. In other words, we have produced an integral space coupling of the speaker to the given room. Experimental models have confirmed the assumed improvement in reproduction. If a properly designed coupling chamber is used between the speaker driver and the throat of the horn, the characteristics of this unit are positively amazing!

As good as this design is, it still leaves much to be desired, for it is far too unwieldly to be considered a practical piece of furniture in the average living room. Is there any way

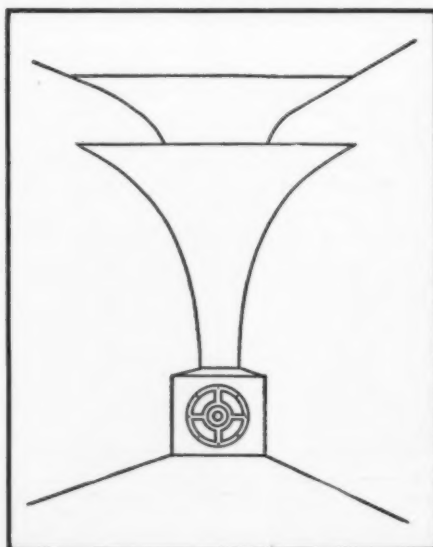
that we can retain the integral space coupling and still reduce the over-all size of the unit? Attacking the problem from a different angle, we know that the main energy of a horn is expended along its axis.

In the case of the vertical corner horn, this effect is further heightened by the solid angle formed by the intersection of the two walls. Consequently, it should be possible to reduce the height of the horn considerably and still utilize the entire room as an extension of the horn.

The horn we have designed and which we call the "integral space transducer" is essentially a horn of the straight type. Its size is no larger than the conventional box-type baffles now available. Despite this reduction in size, we were able to retain the essential efficiency of a full-size exponential horn. The intersection of the walls acts as an extension of the horn length, and the exponent is governed by a basic three-foot, 48-cycle curve which imparts the initial directivity to the sound. As the wavefront advances and meets the ceiling, it is further allowed to expand horizontally along the walls of the room in the confined area made naturally by the intersection of walls and ceiling. The utilization of a vertical directivity of sound in the basic horn, combined with the horizontal direction imparted by adjoining walls and ceiling, give this unit a characteristic closely approaching that of an infinite horn.

Its small size was made possible by careful attention to the degree of effectiveness with which a basic length of horn can govern the expanding wavefront when the exponential restriction is no longer wholly present. For a detailed discussion of this point, see Paul W. Klipsch's article in the journal of the "Acoustical Society of America" for October, 1941. In our research it was found that a basic length of slightly over three feet would suffice to give adequate results

Fig. 3. Fundamental integral space coupling between loudspeaker system and the room.



for the integral space transducer. Another factor which contributed to the small size was a device known as the "sound diffusion reflex coupling chamber." This unique coupling method utilizes a reflective panel made of aluminum, finished in a specially-designed irregular surface which distributes the audio energy equally throughout the throat area. This eliminates the need for complex phase correction plugs. While this method would not be especially desirable for treble frequencies, it is nevertheless remarkably adaptable to the bass range because of its simplicity and rigidity (see Fig. 2).

The basic horn reproduces only the frequencies below 4000 c.p.s. or thereabouts. For the higher frequencies, there is a separate compression-type tweeter with its own integral horn mounted near the mouth of the basic horn (see Fig. 2).

The angle of this tweeter is so arranged that the axial flow of sound will reflect from the corner at a point substantially below the intersection of walls and ceiling. This gives dispersion to the high notes and integrates them into the general sound pattern far more effectively than if the tweeter were allowed to radiate directly into the open room.

The tweeter and bass driver are controlled by a two-channel dividing network having its crossover at 3500 cycles and an outside bandpass with an attenuation of ten to twelve db. per octave.<sup>2</sup> It would have been entirely possible to lower this crossover frequency, but the basic horn would then have been lost on the lower mid-frequency band and would negate the advantages which are so apparent when these frequencies are allowed to emanate from the basic horn.

The actual construction of the integral space transducer lends itself admirably to materials that are easily obtainable. As is evidenced by the illustrations, this unit is of triangular structure which allows for a unique type of fabrication giving license to the use of light, durable materials. The base of the unit is a simple right-triangle of  $\frac{3}{4}$  inch plywood, faced with the metal foil necessary for the sound diffusion reflex coupling chamber.

To this triangle are affixed the two side panels made from  $\frac{3}{16}$  inch tempered Masonite. These two pieces are so tapered as to allow adequate clearance for existing baseboards and mouldings. Upon each of these panels is mounted a curved strut which forms the foundation for the exponential flare, which is a piece of  $\frac{1}{2}$  inch Masonite laid out as a pie-shaped exponential curve. This is fitted to the curved struts, and the resulting enclosure is the basic triangular horn. The two short members are fastened to the curved struts to form a foundation for the trapezoidal speaker mounting board. The ensuing closed

<sup>2</sup> Jensen, Model A40-1.

(Continued on page 130)



# HOME RECORDING STUDIO



Looking into the control room. The plate glass window is tilted to reflect sound toward floor. Polycylindrical wall surfaces are used for sound diffusion. An RCA 77D microphone is shown in foreground.

***A hobby that grew—an ordinary basement room houses this unique recording studio.***

**W**HAT started out as an ordinary hobby has grown into a well-paying, part-time adventure. The JSK recording studio, owned and operated by Julian Krupa, an artist by profession, is located in a basement room of his home at 6024 S. 74th Avenue, Argo, Illinois.

Like all radio hobbyists, Krupa started in a small way by building amplifiers, gadgets, etc. His interests expanded and now he has a studio that is as modern in design and as well-equipped as many of the professionally operated facilities.

Although comparatively small, a 12-piece orchestra has been accommodated with good results in reproduction. Recent additions to the studio were a tape recorder and a specially-designed reverberation chamber. This just shows you what you can do at home in your spare time, if you can afford it.

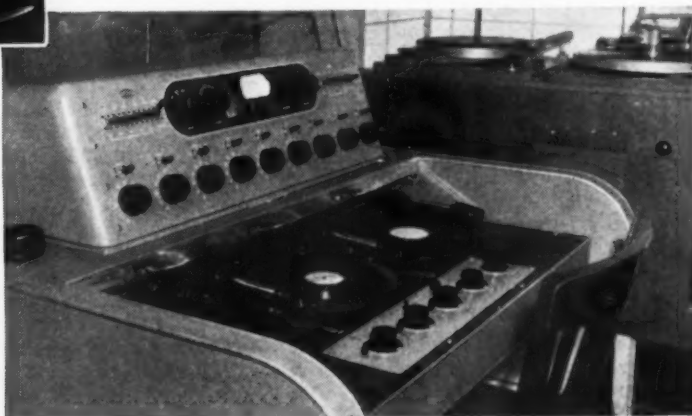
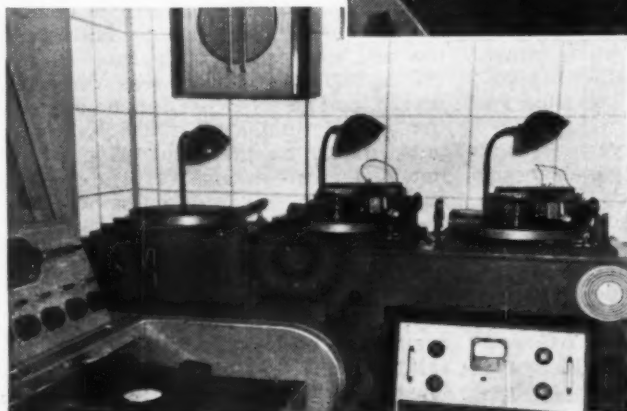
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← Amplifier rack containing AM-FM tuner, power supplies, and equalizer circuits. Amplifiers also feed a reverberation chamber located in room outside of the studio.

↓ Control console made by Raytheon. The desk with sliding shelf was home built and mounts the sound effects, turntables, mixers, and four special mixing preamplifiers.

↑ Rear section of studio with arrangement of sliding drapes for acoustical control in case damping is necessary. An Electro-Voice 635 dynamic mike is used.

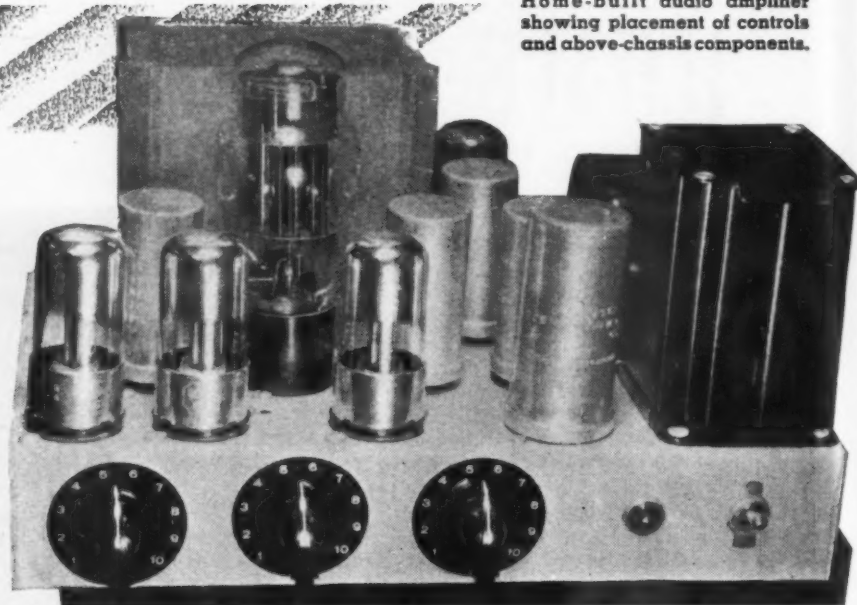
↓ Inside the control room. Two Presto 6N recorders with automatic equalizers. The recording amplifier is on a shelf under the table. Playback unit is on left.





# HIGH- QUALITY AUDIO at Reasonable Cost

Home-built audio amplifier showing placement of controls and above-chassis components.



By

**JOHN V. URBAN**

Staff Eng., WPIX, New York

*Construction details for an audio amplifier designed primarily for use with FM-AM tuners, TV, and record players.*

**T**ELEVISION is providing an ever increasing number of enjoyable looking and listening hours to a rapidly growing number of people. The author has spent many pleasant hours viewing the antics of a favorite comedian or some other type of preferred program. This apparent realization of the listener's dream come true prompted us to dispose of all of our high-quality audio equipment some months ago.

Much to our sorrow, however, one of the greatest deterrents to the realization of perfection in home entertainment has been the apparent disregard for the audio portion of the program, largely at the receiving end. This, of course, has come about due to the demand by the public for lower priced television receivers to which the manufacturers have responded by incorporating audio systems roughly equivalent in response to that of the cheaper a.c.-d.c. midget radio variety.

Transmission of the audio portion of the televised program is accomplished through a frequency modulated signal and generally adheres to high standards. The only exception to this rule is the case where the advantageous studio acoustics of the larger network radio stations are not adaptable for use on television programs and remote sports and television broadcasts. Of

course, the latter generally do not include any wide frequency range transmission, but are generally limited to the voice frequency range of the announcer or master of ceremonies.

The amplifier described herein was constructed in order to enjoy the full audio range of some of the telecasts. It was connected to the audio input stage of a table model television receiver. The results were so gratifying that we are now using the same audio system with an FM tuner, an AM tuner, and a record changer, using a variable reluctance pickup cartridge.

The input of the amplifier requires 1 volt for an output of 8 watts and is wired to a shielded junction box containing a four-position rotary switch for selection of the audio driving source. At an output of 2 watts, which is sufficient for most home installations, the output contains less than 1% total harmonic distortion for any frequency from 100 to 5000 cycles. This is the highest frequency at which measurements were taken, since the fourth and higher order harmonics of this frequency fall outside the useful audio range. The frequency response curves shown in Fig. 1 were made with the aid of a *Hewlett-Packard* audio frequency generator, model 205 AG, and a *Hewlett-Packard* harmonic wave analyzer, Model 300A. The character-

istic curves and distortion measurements were taken on the amplifier which was constructed with "run of the mill" unselected components. The statistics could be greatly improved by more careful balancing in the driver stage and selection of tubes and components, but it was felt that the average constructor would not have the equipment available to do this and would, therefore, be more interested in the results tabulated on a unit made with parts that did not require pre-testing and selection.

The relatively good performance characteristics of the amplifier are due in part to the use of a good output transformer. The constructed unit utilized one of the linear standard series, which is highly recommended. The cheaper series equivalent may be used, though with some sacrifice in performance, noticeable especially in distortion at the higher output levels and frequency response at both the low and high end of the range. Since the speaker voice coil was directly driven, and no other use for the amplifier was contemplated, a 500-ohm output winding on the transformer was not deemed necessary, resulting in a substantial saving in the cost of the transformer.

The output stage of the amplifier utilizes the low mu twin triode, 6AS7G. This tube is of the heater cathode type primarily designed for voltage regulator service. It will conduct a relatively high plate current due to its low plate resistance, and this is a dis-



tinct advantage, since in audio service it serves to dampen the loudspeaker very effectively. Damping is achieved by the use of inverse feedback when tubes having high plate resistances, such as pentodes or beam tetrodes, are used as output amplifiers. In many cases, however, feedback loops introduce regeneration and phase distortion at certain frequencies. This is especially true when the feedback loop includes resistance-capacitance networks to boost or attenuate a particular range of frequencies. It is also true that feedback lowers the gain of an amplifier, so that the advantage of the sensitivity of the multi-grid output tube is somewhat offset by its need for feedback.

Each section of the 6AS7G receives its bias through a separate resistor. This provides a self regulatory action, since if one section is inclined to draw more plate current it will increase its bias and hence tend to maintain a balance with the other section. A total of four tubes was tried, and each operated within acceptable limits. If the unbalance between sections should exceed 5 ma., the cathode bias resistors should be decreased to 2000 ohms

each, and a 1000 ohm balancing potentiometer (wirewound 4 watt rating) inserted in series with the end of each cathode resistor and the arm of the potentiometer grounded. (See schematic diagram Fig. 2.)

The use of the 6AS7G as an audio amplifier output stage has been hampered by its relatively low amplification factor of approximately 2. It is easily driven to the better than 8 watts output by the use of a push-pull 6SN7GT driver stage. Distortion in the driver is minimized by the push-pull circuit and the use of unbypassed cathode resistors which provide degeneration. A driver transformer was not used since a good one is an expensive item and would raise the over-all cost considerably.

The driver stage is preceded by half of a 6SN7GT, which functions as the familiar split load type phase inverter, chosen for its simplicity and balance, and which will supply output voltages of opposite phase sufficiently equal without the need for careful balancing. Since the driver stage is not followed by high amplification, the danger of hum disturbances due to heater cathode leakage is minimized. This

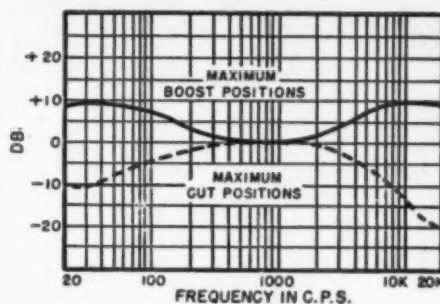


Fig. 1. Over-all frequency response curves of the home-built audio amplifier.

type of hum sometimes prohibits the use of this means of phase inversion when it is followed by high amplification.

The other half of the 6SN7GT is used as a voltage amplifier. With the possible exception of the large bypassing and coupling condensers, this stage is conventional in every respect. These are essential for minimum hum as they bypass hum voltage originating between the heater and the cathode, and are also necessary for good low-frequency response. The audio frequency voltage developed across the

$R_1, R_2$ —2 megohm audio taper pot.  
 $R_3$ —2.2 megohm,  $\frac{1}{2}$  w. res.  
 $R_4$ —250,000 ohm audio taper pot.  
 $R_5, R_6$ —1200 ohm,  $\frac{1}{2}$  w. res.  
 $R_7$ —51,000 ohm,  $\frac{1}{2}$  w. res.  
 $R_8$ —510,000 ohm,  $\frac{1}{2}$  w. res.  
 $R_9, R_{10}, R_{11}, R_{12}, R_{13}, R_{14}$ —47,000 ohm, 1 w. res.  
 $R_{15}$ —15,000 ohm,  $\frac{1}{2}$  w. res.  
 $R_{16}$ —10,000 ohm,  $\frac{1}{2}$  w. res.  
 $R_{17}, R_{18}, R_{19}, R_{20}, R_{21}, R_{22}, R_{23}, R_{24}, R_{25}, R_{26}$ —470,000 ohm,  $\frac{1}{2}$  w. res.  
 $R_{27}$ —1500 ohm,  $\frac{1}{2}$  w. res.  
 $R_{28}$ —4700 ohm,  $\frac{1}{2}$  w. res.  
 $R_{29}$ —47,000 ohm,  $\frac{1}{2}$  w. res.

$R_{29}$ —22,000 ohm,  $\frac{1}{2}$  w. res.  
 $R_{30}, R_{31}, R_{32}$ —2700 ohm,  $\frac{1}{2}$  w. res.  
 $R_{33}, R_{34}$ —2500 ohm, 10 w. wirewound res.  
 $C_1, C_2, C_3, C_4, C_5, C_6, C_7, C_8, C_9, C_{10}, C_{11}, C_{12}, C_{13}, C_{14}, C_{15}, C_{16}, C_{17}, C_{18}, C_{19}, C_{20}$ —1  $\mu$ fd., 400 v. cond.  
 $C_{21}$ —30  $\mu$ fd. mica cond.  
 $C_{22}$ —300  $\mu$ fd. mica cond.  
 $C_{23}$ —0.03  $\mu$ fd., 400 v. cond.  
 $C_{24}$ —0.001  $\mu$ fd., 400 v. cond.  
 $C_{25}$ —0.01  $\mu$ fd., 400 v. cond.  
 $C_{26}, C_{27}, C_{28}, C_{29}, C_{30}$ —10  $\mu$ fd., 450 v. elec. cond.  
 $C_{31}$ —50  $\mu$ fd., 50 v. elec. cond.  
 $C_{32}$ —25  $\mu$ fd., 400 v. cond.  
 $C_{33}, C_{34}$ —40  $\mu$ fd., 150 v. elec. cond.

$C_{35}$ —80  $\mu$ fd., 450 v. elec. cond.  
 $T_1$ —5000 ohm plate-to-plate to load output trans. (UTC LS57, CG16 or Chicago Transformer PC080)  
 $T_2$ —Power trans. 375-0-375 v. @ 150 ma., 6.3 v. @ 5 amps., 5 v. @ 2 amps. (Thorndarson T22R33, or Stancor P6014)  
 $S_1$ —S.p.s.t. toggle sw.  
 $CH_1$ —10 hy., 150 ma. filter choke (UTC S29)  
 $F_1$ —2 amp. fuse  
 $PL_1$ —6.3 v. pilot lamp  
 $V_1, V_2, V_3$ —6SN7 tube  
 $V_4$ —6AS7 tube  
 $V_5$ —5Y3 tube

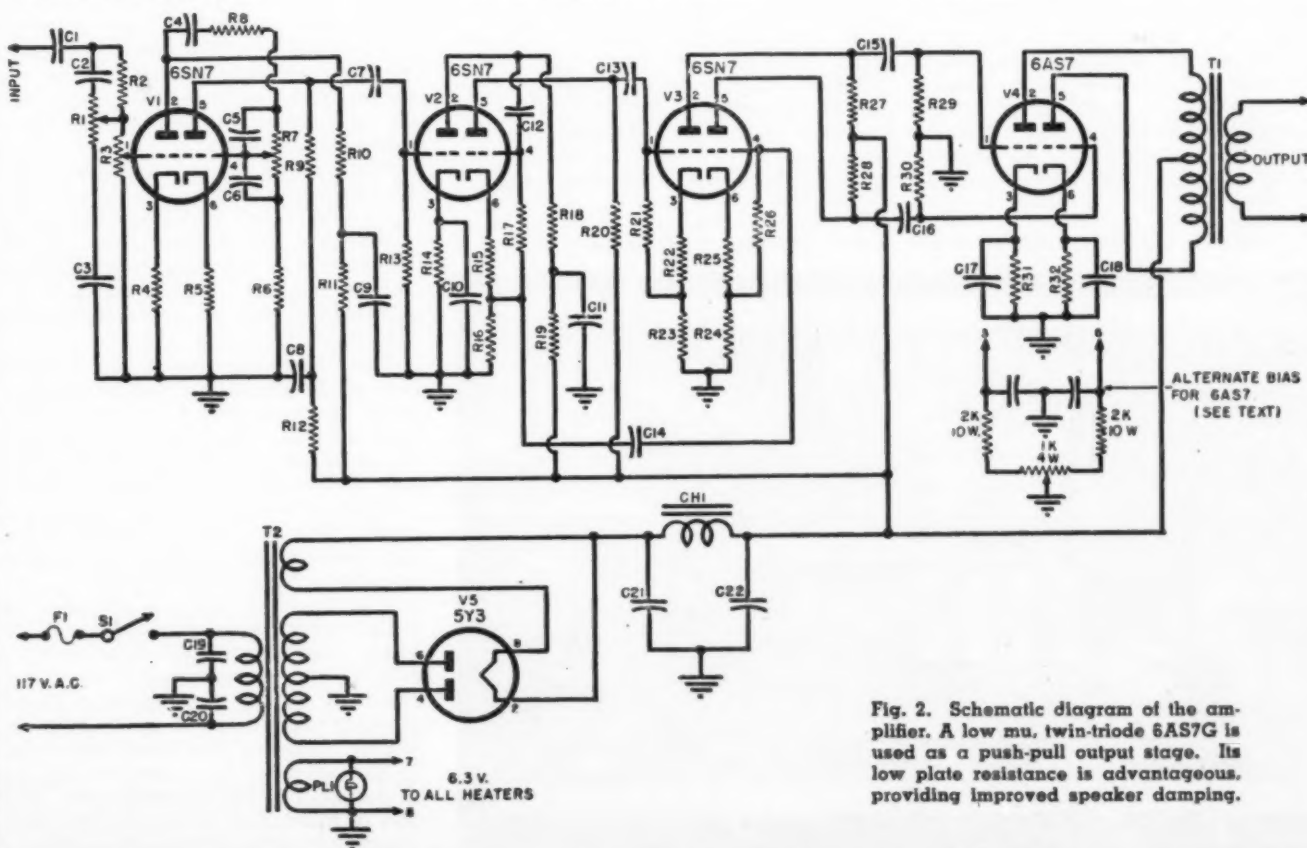
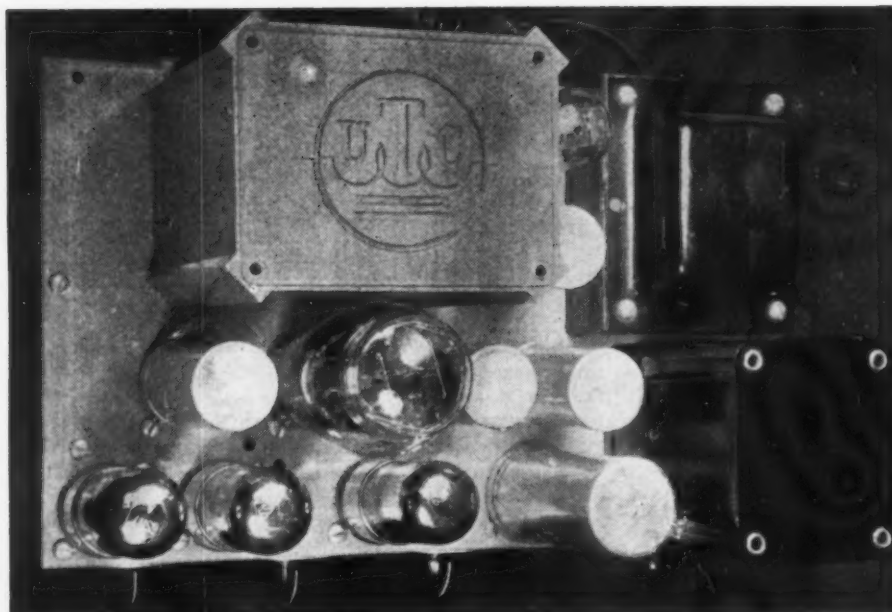


Fig. 2. Schematic diagram of the amplifier. A low mu. twin-triode 6AS7G is used as a push-pull output stage. Its low plate resistance is advantageous, providing improved speaker damping.





Top view of the audio amplifier, showing relative placement of components.

cathode circuit impedance is equal to the total voltage developed in the plate circuit, multiplied by the ratio of cathode circuit impedance to the plate circuit impedance. This voltage across the cathode impedance will act in a degenerative manner reducing the low-frequency response if the bypassing condenser is not sufficiently large.

The tube complement of the amplifier is completed with the use of a third 6SN7GT, which functions as a separate high and low frequency amplifier control stage. There is no interaction between the stages or controls. The circuit values are chosen so that there is the least effect upon the frequencies from approximately 600 to 800 cycles. The low frequency control will boost 9 db. at 40 cycles and attenuate 10 db. at 40 cycles when set in extreme positions. The boost is gradual to about 150 cycles, and it

then rises sharply to a peak at 40 cycles. This is a desirable characteristic inasmuch as it tends to decrease the annoying bass boominess of a human voice when excessive boost is present at 200 to 300 cycles, and it also provides the boost necessary below 100 cycles to bring out to advantage the lows of the drum and bass string instruments.

The high frequency control will boost the response 10 db. at 20,000 cycles and attenuate it 20 db. at the same frequency. Both of the tone control potentiometers are of the audio taper type (in which the 10 percent resistance point occurs at 50 percent rotation), and these will provide substantially linear response when set at 50 per-cent rotation. With the amount of control available, one naturally feels there must be some disadvantage, and this is revealed as an in-

section loss of 20 db. at 800 cycles. On the other hand, if the selective feedback method of tone control had been used, it would have necessitated a corresponding loss in gain and might have resulted in some regeneration and transient distortion.

Except for the relatively high capacitance output filter condenser and large bypass and decoupling networks, the power supply is entirely conventional in every respect. It was found necessary to use at least an 80  $\mu$ fd. output filter condenser to prevent low frequency motorboating and instability due to the low frequency boost stage.

A very desirable feature in most equipment is reasonable compactness, and this entire amplifier and power supply were assembled on a 7"x9"x2" chassis. Good construction practice will call for a good grounding technique for the tone control stages. No separate ground bus was found necessary after the unit was completed. Grounding for the tone control stages should be made to one point on the chassis. One side of the heaters is grounded, but in no case should this point be used for grounding any other circuit components. The heaters are wired in parallel and grounded at the transformer negative return point. The heater of the 6AS7G is rated at 6.3 volts a.c. 2.5 amperes, and at least #20 wire should be used for this wiring, especially if a larger chassis is used and a longer filament run is necessitated.

The input of the amplifier was wired to the shielded junction box, using low capacity, low loss shielded wire, but a single contact microphone connector and chassis receptacle may be substituted if desired. Output of the unit is wired to an octal socket on the rear apron of the chassis and is used with an octal male connector and twisted pair speaker cable.

Many excellent preamplifiers giving the proper compensation have been described in this and other magazines.

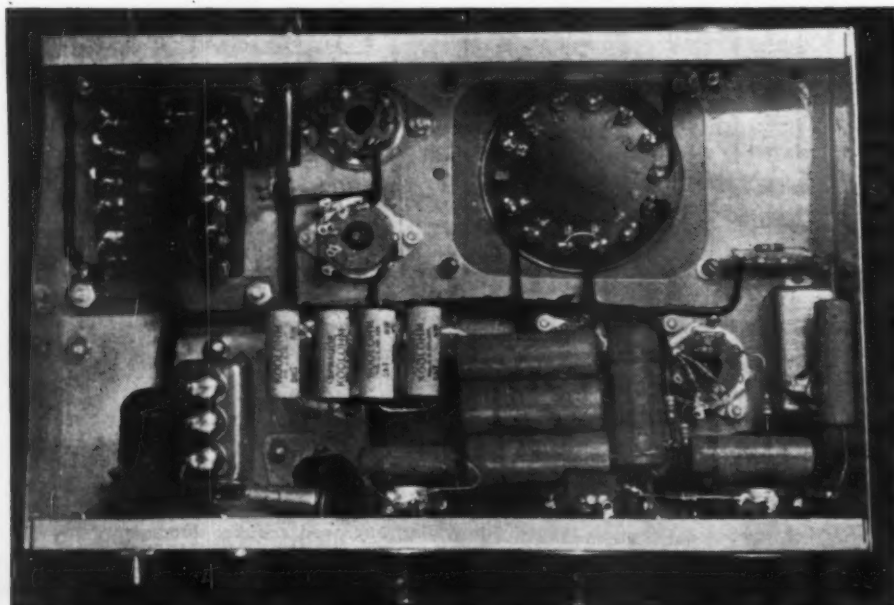
The type of equalizer and amplifier which allows the characteristics to be varied to suit various pickups will probably be the most satisfactory for the majority of users.

For full realization of the capabilities of the amplifier, the input source must be a good one. Live music broadcast over the local frequency modulation stations has proved excellent. If one of the variable reluctance pickup cartridges is used for phonograph reproduction, the tone control stages do not obviate the need for a properly equalized input preamplifier.

The speaker system includes the speaker and its proper baffle. A separate low and high-frequency, or coaxial type, reproducer is recommended. During the amplifier tests, a 10-watt rated speaker made by a reputable manufacturer was destructively damaged by the output of the amplifier at the lower frequencies. With this in mind, it is recommended that a speaker system capable of handling 20 watts be used with this unit.

-30-

Under-chassis view. Note, particularly, neatness of wiring and parts assembly.





# WMOR'S SUPERSONIC TONE Selects Receivers

By **DAVID B. PIVAN**

Chief Engineer, WMOR

*Special shopping tips to customers  
in Chicago's many National and Jewel  
stores bring added revenue to station.*

R. J. Wood, Jr., manager of station WMOR, points out first Jewel Food Store loud-speaker installation to Roy Martin (left), store manager, and a representative of Consumers Aid, Inc. (right).

**L**ARGEST independent FM broadcaster in the Midwest, Station WMOR is located in the heart of Chicago, its antenna mounted atop one of the tall "Loop" skyscrapers. An effective radiated power of 40,000 watts provides it with a service area comprising a radius of 75 miles. Any receiver using a good FM antenna will consistently pick up the programs at distances of more than a hundred miles. This coverage does not vary from day to night, nor is it disturbed by heterodynes or static noise, and it possesses a measure of fidelity that amazes "dyed in the wool" AM listeners.

Staff members of WMOR believe they have found the key to successful FM broadcasting by airing shows that cannot be obtained to any extent on AM or other FM stations, i.e., programming special events and featuring personalities. During the daytime hours, instrumental music is transmitted and may be heard in the nearly two hundred supermarkets of Chicago's two major food chains. Shoppers in these stores are diverted by pleasant background music, plus an occasional shopping tip.

Receivers in the stores are equipped with selective filters actuated by a supersonic tone that is superimposed upon the commercial announcement. The output of the filters can be used to silence the announcement or to

boost it, whichever is desired. The manner in which it is accomplished is shown in the block diagram. Although only two selective filters are indicated, additional ones may be added to perform such functions as automatically turning the remote receivers on and off.

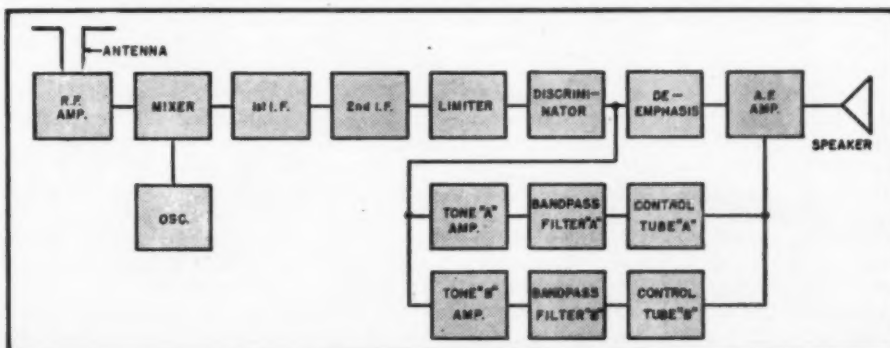
Two main studios are provided at WMOR for the origin of live shows, both of which are treated acoustically to give a somewhat longer reverberation time than is commonly attained. The resulting programs have a "liveness" that further increases the realism of the high-fidelity broadcast. High fidelity has come to mean many different things in the past few years, but at WMOR it refers to "true fidelity." Whether or not the public as a

group actually desires true fidelity is not certain. One-time listener tests have not indicated conclusively that there is a preference one way or the other, but tests conducted over a period of time show a decided trend toward as exact a reproduction of the original sound as is possible. All of the audio equipment in the studios is designed with that purpose in mind and has a flat response from 20 to 20,000 cycles within 1½ db.

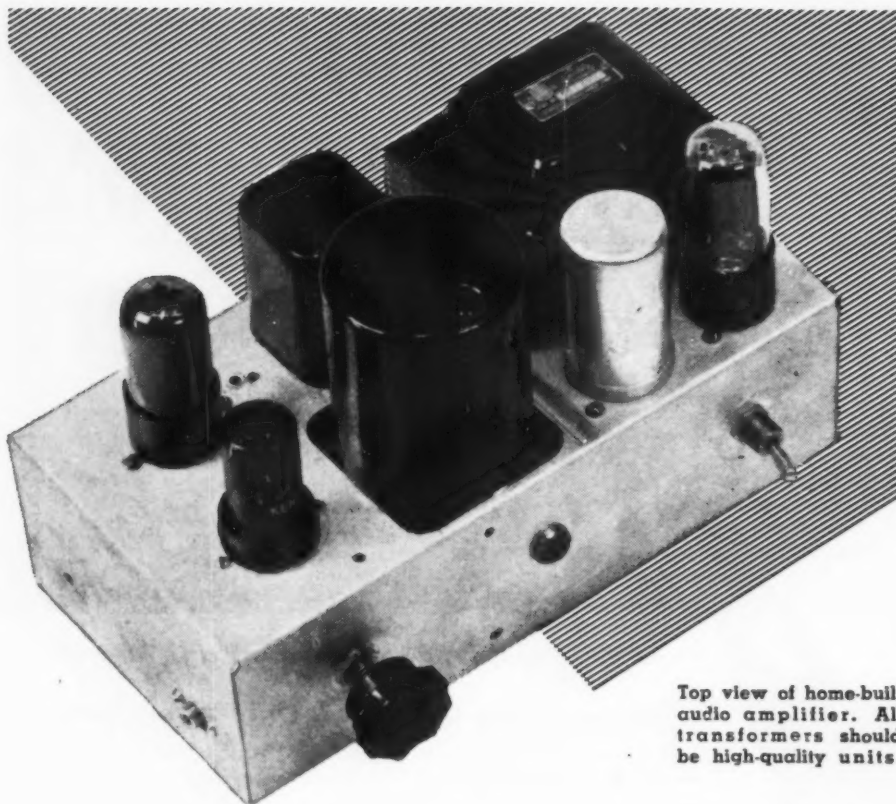
Two transcription libraries are maintained at WMOR, *Capitol* and *World*, the latter being a vertical service. Transcriptions with low surface noise are played "wide open," that is, equalized to correspond to the recording characteristic. These transcriptions have a high-frequency response to 10,000 c.p.s., with some going considerably higher. Shellac pressings, with the exception of a few foreign labels, seldom have high-frequency response above 7000 c.p.s. Consequently, when these records are played it is necessary to employ a high-frequency roll-off to improve the signal-to-noise ratio.

(Continued on page 116)

Fig. 1. Block diagram of a supersonic tone controlled receiver.







Top view of home-built audio amplifier. All transformers should be high-quality units.

# A Direct-Coupled AMPLIFIER With Cathode Follower

*Two novel circuits in a single audio amplifier provide wide frequency response with a minimum of distortion.*

**T**HE construction of the amplifier to be described in this article was actually initiated a little over two years ago, at which time I became an enthusiastic audio ham. During the recent war I was associated with radar in a practical way and so became acquainted with the cathode-follower which was used extensively in radar as an inexpensive medium for matching a high impedance to a low impedance in voltage amplifier stages. At that time, it appeared to me that the cathode-follower might be ideally suited for audio output stages where the problem of getting a good impedance match is generally difficult and usually expensive. With this in the back of my mind, I began experimenting with all types of audio amplifiers, searching for a circuit that would provide a lot of performance for a mini-

mum of parts. Previous issues of *RADIO & TELEVISION NEWS*, I discovered, had described both cathode-follower and direct-coupled amplifiers as separate circuits. I could not find any articles that described an audio amplifier with both direct coupling between stages and cathode-follower output. So, using old issues of *RADIO & TELEVISION NEWS* as source material, I proceeded to construct this amplifier.

As can be seen in the schematic diagram, the circuitry is extremely simple.

There are two features that give this amplifier its superior performance. One is direct coupling between the plate of the 6SJ7 and the grid of the 6V6. The other is the cathode-follower output from the 6V6.

In addition to its simplicity, direct coupling eliminates the undesirable

By  
**RAYMOND H. BATES**

characteristics that are inherent in ordinary resistance-capacitance coupling, such as short circuiting of weak signals and grid blocking of strong signals.

The cathode-follower output, in addition to its simplicity, provides both improved high and low frequency response, damping out of all the peaks in both the output transformer and speaker, less distortion, and 100 percent degenerative feedback.

In order to determine the circuit values in the schematic, free use was made of the tube manuals and Kirchhoff's and Ohm's laws. Commencing with the output stage in the conventional manner, the tube manuals indicate that for a single-stage output, a 6L6, 6V6, 6F6, or 6K6 are likely output tubes. The 6V6 was selected because of its ready availability and relatively lower percentage harmonic distortion rating. The 6SJ7 was chosen mainly because of its high gain and low percent distortion.

In order to keep power requirements down, I chose a 350 v., center-tapped, 120 ma. (53 ma. only required) power transformer which is readily available at moderate cost. Allowing for a 15 volt drop in the filter choke and a 250 volt drop from the plate to the cathode of the 6V6, 85 volts is available at the cathode of the 6V6. Since in a direct coupled circuit the grid bias, 12.5 volts in this case, is obtained by the voltage differential between the cathode and grid, approximately 73 volts is required at the grid of the 6V6 (and at the plate of the 6SJ7, inasmuch as these two tube elements are connected directly together). With 73 volts at the plate and 55 volts at the screen of the 6SJ7, a voltage amplification of 115 can be obtained at only .8 per-cent distortion. This means that a .1 volt signal at the grid of the 6SJ7 will provide a 11.5 volt signal at the grid of the 6V6 which is considered adequate.

In accordance with Kirchhoff's law, the voltage and current distribution around the circuit is indicated in the schematic. Note that there is a 12.5 volt drop through the d.c. resistance of the primary of the output transformer which was measured to be approximately 250 ohms. The cathode-follower output is obtained simply by connecting the transformer to the cathode of the 6V6 and tying the plate and screen of the 6V6 together to the "B plus" supply, as shown.

The output of the amplifier is approximately 4.5 watts. While this figure may seem low to those accustomed to dealing with amplifiers having an output of 20 or more watts, it is entirely adequate for home use when an efficient speaker system is used.

Tests made by various organizations have shown that for listening in the average home living room, an output

**RADIO & TELEVISION NEWS**



of less than one watt is generally used. The only reason for providing more power than this is to allow for the peak passages that occur in some classical compositions.

The input sensitivity is such that even the high-quality, low-output crystal pickups will provide sufficient drive.

No provision has been made for the use of variable reluctance pickups, although there is no reason why such units could not be used if a preamplifier stage were added. There have been many satisfactory preamplifiers described in various issues of this magazine.

In the event a preamplifier is used for the magnetic pickups, great care should be exercised in the shielding and placement of parts to avoid hum pickup. The careful selection of the tube used in the preamplifier will aid materially in the reduction of hum.

There is sufficient reserve capacity in the power supply to take care of almost any type of preamplifier without any trouble.

No provision for tone controls has been made, although they could be added with little difficulty. There is a great deal of controversy as to the best type of tone control, and it was felt that they could be added at a later date when the most satisfactory type had been determined by experiment.

It is essential that the primary of the output transformer,  $T_1$ , have a resistance of approximately 250 ohms, as the resistance of this winding determines the grid bias for the 6V6. A check of the various types of transformers on the dealers' shelves by means of an ohmmeter will be sufficient. The primary impedance of this transformer should be from 5000 to 6000 ohms, with the higher value giving slightly less distortion.

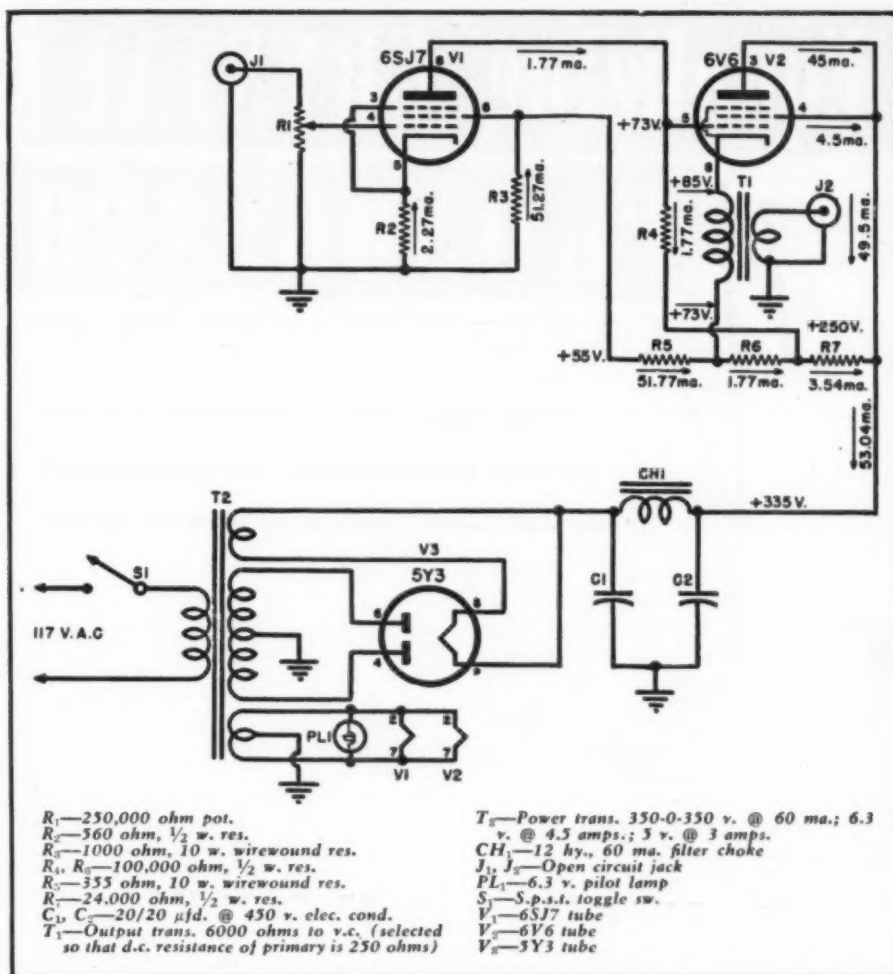
The voice coil winding should be selected to match the speaker in use. Most of the better speakers have an impedance in the vicinity of 8 ohms, and for that reason this value is specified.

It is not essential that this transformer be of the sealed type, but it should be of good quality so that the full benefit of the amplifier may be realized. Poor transformers are usually deficient in frequency response at the upper and lower frequencies.

The power supply, being conventional, needs no explanation.

As can be seen in the photographs, the construction of the amplifier is simple and straightforward, with point to point wiring being used throughout. All the parts used are of good quality, all chokes and transformers being shielded and/or hermetically sealed. The total cost is slightly less than ten dollars. By observing the usual precautions, twisting filament leads, etc., hum is inaudible at full gain.

When used with a good-quality tuner or record reproducer and a well baffled extended range speaker, the performance of this amplifier is superior for average living-room listening. The author used a Pilotuner for FM pro-



Complete schematic diagram of direct-coupled cathode-follower amplifier.

grams, a Webster dual speed record player for reproducing the conventional 78 r.p.m. and Columbia 33 $\frac{1}{2}$  r.p.m. records, an RCA player for the new 45 r.p.m. records, and a Jensen bass reflex reproducer.

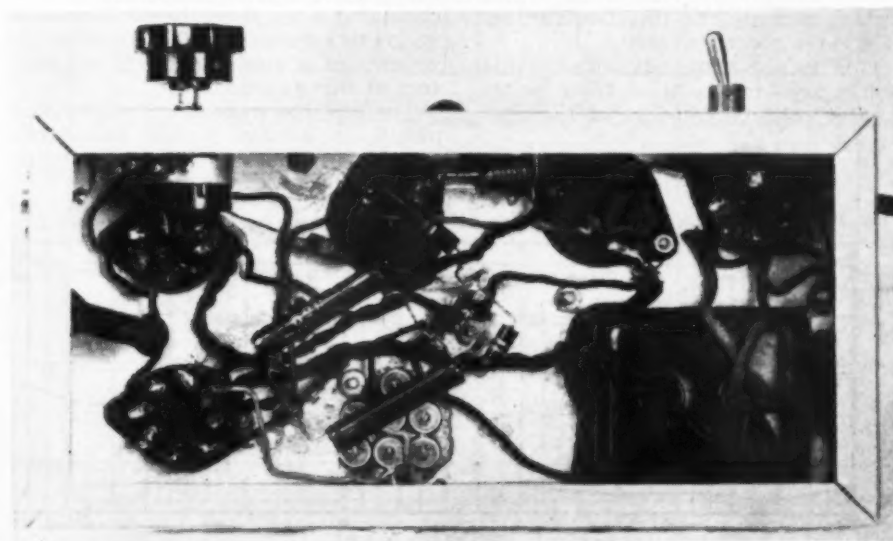
Lacking laboratory test equipment, the author could not conduct the usual harmonic and intermodulation distortion tests on this amplifier. However, judging from extensive living-room

listening tests, using recordings ranging from the RCA Victor Red Seal version of "Night on Bald Mountain" to the Capital Stan Kenton rendition of "Peanut Vendor," this amplifier leaves little to be desired.

If you've never listened to a direct-coupled cathode-follower amplifier, then you have a pleasure to look forward to while constructing this one.

—30—

Under-chassis view shows relative placement of miscellaneous components.





# Equalizing CRYSTAL

By  
**CHARLES P. BOEGLI**

Cincinnati Research Co.\*

# PHONOGRAPH PICKUPS

**New equalizers provide crystal pickup performance comparable to that of high-quality magnetic units.**

**T**HE RELATIVELY recent development of a series of magnetic pickups typified by the *Clarkston RV*, *General Electric* variable reluctance, *Pickering*, and a number of others, has set new standards of phonograph record reproduction. These units operate well with low stylus pressures, and the playback is characterized by remarkable "cleanness" and freedom from needle talk and record scratch. Not to be outdone, manufacturers of crystal pickups have concentrated on evolving improved units, and some recent products track satisfactorily with even lower stylus pressures than the magnetic pickups.

Crystal pickups capable of providing wide-range response are not new; until recently, however, their cost has been high. It is customary to feed the signal from these pickups directly into a high-impedance grid circuit, often employing a series equalizer, and under these conditions, as contrasted with late magnetic units, the crystal pickups generally have the advantages of higher voltage output and a lack of susceptibility to hum pickup. On the other hand, for a given frequency range, the reproduction with crystal pickups has the disadvantage of greater record scratch.

This is not primarily attributable, as has popularly been supposed, to the greater relative response of the crys-

tal pickups to vertical stylus movement (the common belief being that "The noise is on the bottom of the record groove while the music is on the sides"), but rather to the superior inherent damping of the magnetic cartridge arising both from its low internal impedance and the low loading resistance that is as a result permitted without detrimental effect on the frequency response<sup>1, 2</sup>. The low impedance circuit effectively prevents resonant oscillations of the stylus when a particle of grit or dust is encountered and in this manner reduces the scratch level. Thus, the scratch level is somewhat akin to the "hangover" effect encountered in power output stages when pentodes are used without feedback. The same factors, of course, influence the "cleanness" of reproduction. Consequently, it may be assumed that when all other factors (like mechanical stylus damping) are equal, the lower-impedance pickup circuit will result in less noise and cleaner reproduction.

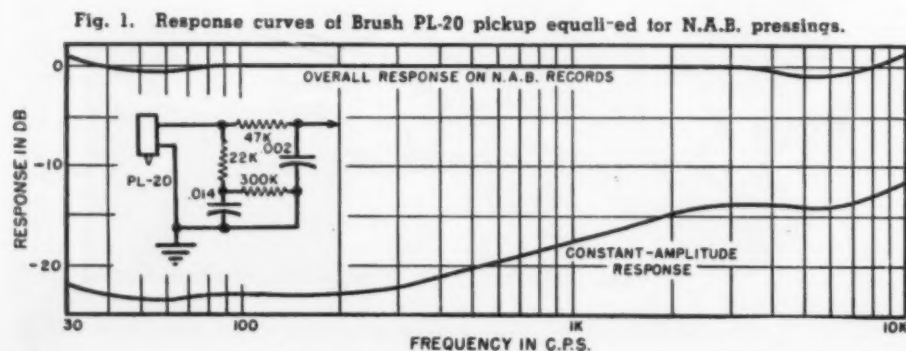
It has been found that with proper equalization, the impedance of the crystal pickup input circuit can be greatly reduced, and results attained comparable to those to be had with magnetic pickups. The manner in which this is accomplished is the subject of this paper.

The internal impedance of a crystal pickup is almost purely capacitive. If such a pickup is loaded in the cus-

tomary manner with a resistance, the constant-amplitude bass response will drop off 6 db. per octave below the frequency at which the internal impedance of the pickup equals the load resistance. To extend the response down to a reasonably low frequency requires an extremely large load resistance; for example, a pickup having .001  $\mu$ fd. internal capacitance requires a load resistance of 5.3 megohms for flat response to 30 c.p.s., assuming no low-frequency peak arising from arm resonance. With some pickups a low-frequency peak exists and this reduces the required load resistance by a small amount. Under any circumstances, this is practically equivalent to open-circuit conditions, and scratch occurring at higher frequencies is quite pronounced. The general practice with crystal pickups is to use a load resistance of the order of .5 megohm and accept the resulting low-frequency loss.

As the load resistance is decreased, the frequency at which bass attenuation begins becomes higher, but the damping of the circuit becomes better. If the load resistance is made equal to the internal impedance of the crystal at, say, 15 kc., the constant-amplitude response will drop 6 db. per octave below 15 kc. over the entire audible range. This means that the pickup is now velocity-responsive over the audible range and is, in respect to response, behaving like a magnetic pickup. In addition, under these circumstances, the low value of load resistance provides very good damping, reducing the needle scratch and markedly improving cleanness of reproduction. The output voltage of the pickup is considerably reduced at low frequencies and is of the order of some of the high-output magnetic devices.

A brief calculation will show that with these conditions the impedance of the entire input circuit at high frequencies is of the same magnitude as that attained with customarily loaded magnetic cartridges. The "hangover" effect is most objectionable at these frequencies, and here the crystal cartridge gives performance comparable to the magnetic unit. At low frequencies, however, the crystal cartridge circuit impedance is high, and much more "hangover" occurs than in the case of the magnetic unit. Although not very objectionable, the resonance is noticeable, and it consti-



\* 6431 Montgomery Ave., Cincinnati 13, Ohio



tutes the principal remaining disadvantage of the crystal unit.

Most commercial crystal pickups display a high-frequency peak due to needle resonance, and the optimum value of load resistance is equal to the crystal impedance at the frequency where open-circuit, high-frequency response is up 3 db. because of needle resonance. Under these circumstances, the resonant peak is minimized and high-frequency response drops off sharply above the peak.

With such a circuit, the low-frequency turnover of commercial pressings is easily compensated for by inserting, in series with the load resistor, a condenser whose reactance equals the load resistance at the turnover frequency. The load circuit and the capacitance of the pickup then form a capacity voltage divider below the turnover frequency, and the system is amplitude-responsive in this range. Furthermore, the parallel impedance of the pickup and equalizer is very low, so that even with a .5 megohm shunt, as is encountered in the input of a great many amplifiers, the bass response extends to very low frequencies indeed, of the order of 10 to 20 c.p.s.

Almost all modern commercial pressings have some form of high-frequency pre-emphasis, for which it is also desirable to equalize. This can easily be done by means of a simple lossier circuit inserted after the low-frequency equalizer. This additional section must have a sufficiently high impedance not to affect the performance of the first network but not so high as to be affected by the input shunt resistor or stray capacities.

The primary requirement for successful equalization in this manner is that the response of the crystal cartridge be substantially uniform over the desired range. A peak at high frequencies due to needle resonance is permissible, but it must be remembered that high-frequency response will not extend above this peak. The same situation exists with respect to the low frequencies; a peak does no damage but response cannot be expected to extend below the peak.

Furthermore, if the peaks are inordinately high (evidence of poor design) they will not be completely removed by the equalizer.

### Examples of Equalizer Design

For standard records the *Brush* PL-20 crystal pickup, for example, has all of the many desired characteristics. The open-circuit response for the PL-20 cartridge, as published by the *Brush Development Company*, is shown in Fig. 3. It will be noted that the response is up 3 db. at about 7300 c.p.s., and since the internal capacitance is .001  $\mu$ fd.,<sup>3</sup> the proper load resistor is 22,000 ohms. The response of the cartridge loaded with this resistance is shown in Fig. 1. The low-frequency peak causes a rise of 3 db. at 36 c.p.s.

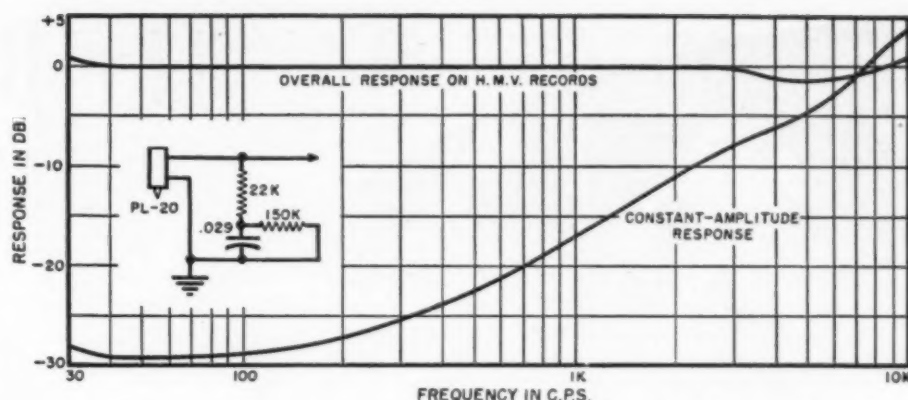


Fig. 2. Response curves of Brush PL-20 pickup equalized for H.M.V. pressings.\*

British H.M.V. and some other foreign records follow a very simple characteristic, with a turnover at 250 c.p.s. and no treble emphasis.<sup>4</sup> Compensation for this turnover frequency is easily made by inserting, in series with the load resistor, a condenser whose impedance equals the load resistance at 250 c.p.s.; that is, a .029  $\mu$ fd. condenser. The last step is to remove the low-frequency peak by shunting this condenser with another resistor equal in size to the impedance of the condenser at 36 c.p.s.; this turns out to be 150,000 ohms. The completed equalizer and the calculated frequency response are shown in Fig. 2.

The N.A.B. recording characteristic (used in *Artist*, *Capitol*, *M.G.M.*, and other pressings) requires a second equalizer section to compensate for the treble pre-emphasis. The first section is computed in a manner similar to that just described and found to consist of a 22,000 ohm resistor in series with a .014  $\mu$ fd. condenser, which is, in turn, shunted by a 300,000 ohm resistor. The second section can consist of a 47,000 ohm series resistor and a .002  $\mu$ fd. shunt condenser; the complete equalizer and the calculated response are shown in Fig. 1.

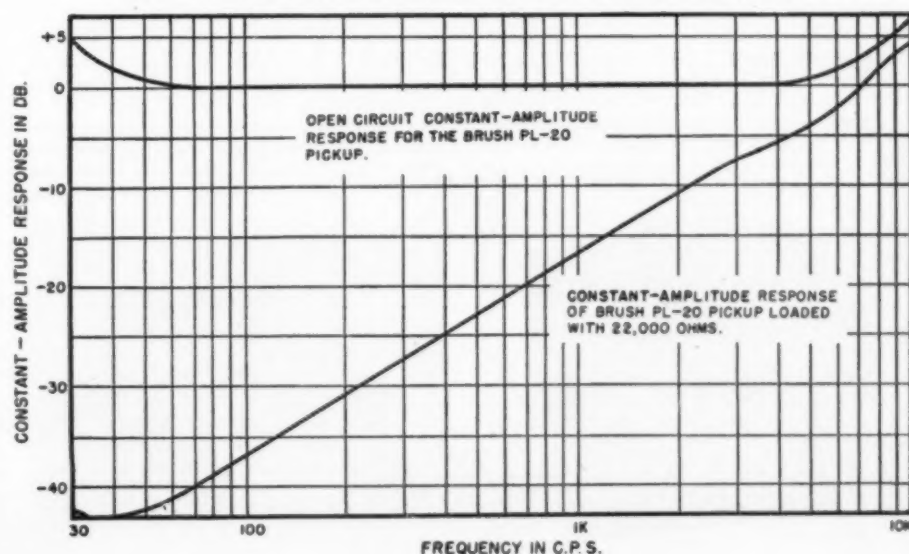
It is of interest to note that this

particular recording characteristic could also have been compensated by loading the cartridge with a 100,000 ohm resistor in series with a .0032  $\mu$ fd. condenser. In this case, the change of crystal capacitance with temperature will upset the high-frequency equalization. In the previous case the load resistor was selected with no other purpose than the elimination of the high-frequency peak and a change in crystal capacitance is not likely to have any noticeable effect.

The same procedure can be carried out with long-playing records for any pickup displaying the previously described characteristics. *Columbia* Microgroove records follow the N.A.B. characteristic except for additional bass boost amounting to 3 db. at 100 c.p.s. Correction for this boost can be made in the same manner as was shown for a bass rise due to the pickup arm, but it is evident that any residual rise because of arm resonance then remains uncompensated. If desired, this resonant rise can be removed by an additional equalizer section, but this expedient is likely to be difficult, and the best procedure is probably to leave the arm resonance uncompensated.

In conformity with the above principle (Continued on page 152)

Fig. 3. Constant amplitude response curves of the PL-20 Brush pickup.





# The BEGINNING AMATEUR



One-handed control makes mobile W2NFM easy to operate. Sid Tritsch, of Forest Hills, N. Y., shows how easy it is to tune up his trunk-mounted ten-meter rig.

By ROBERT HERTZBERG

W2DJJ

**Part 10. Put your ham shack on wheels, get away from TVI and other interference problems, and you will have a lot more fun on the air.**

**"T**HERE'S nothing like it!"

That's the enthusiastic comment you get from any ham who has put a rig in his car, and for good reason, too. Mobile operation is in a large way the answer to TVI and many other problems that beset ordinary fixed stations. With a converter on the dashboard and a transmitter in the trunk compartment, you can pick your own location and enjoy extremely interesting local and DX contacts. In some parts of the country, particularly the crowded East, mobile has saved ham radio from virtual extinction, and clubs whose members work mobile only are springing up overnight. Putting your radio

A husky, 5-tube job, rated at about 28 watts, is the Stancor Model ST-203-A. This is intended for trunk compartment mounting, and has a frequency coverage of 27 to 32 mc.



"shack" on wheels gets you out into the open air and helps you to reestablish friendly relations with your friends and family.

"Mobile" doesn't mean only "auto"-mobile. You can operate from boats and airplanes and, for that matter, from bicycles and motorcycles, if you have three or four hands!

There is some confusion as to the difference between "mobile" and "portable." The first term applies to operation in a vehicle while the latter is moving or stationary. The second describes a temporary displacement to a fixed location other than that indicated on the station license; for example: You move from your regular

The Gonset three-band converter, giving continuous coverage from 3 to 30 megacycles over three bands. It uses four tubes and the dimensions are 5¼ by 3½ by 5½ in.



house to a summer camp, cottage, bungalow, etc., where you will remain for a couple of months. If you want to set up a small station there, you have only to write a brief letter informing the office of the FCC having jurisdiction over that particular area. You will use your regular call letters, followed by the number of the call district. On phone, you sign off by saying, "This is W2XYX portable two," if you're still in the second district; or "This is W2XYZ portable one," if you happen to be somewhere along the Connecticut shore, in the first district. The FCC must be notified every month; you're allowed three renewals, or a total of four months of "portable" status. Beyond that, you have, in effect, moved to a permanent location, and you must apply for a modification of your ticket.

For mobile operation, you should notify the FCC only if you expect to be gone from your home-base more than 48 hours; you don't have to bother with paper work if you're out for a short week-end drive. For more than two days of mobile service, you are required to write to the FCC and to renotify them monthly. There is no time limit, as with portable operation. If you decide to make a grand tour of the United States, you can work mobile all along the way if you remember only to send the FCC a notice every thirty days.



Although mobile operation is now permitted on any or all of the ham frequencies, from the practical standpoint only the frequencies above 27 megacycles are worth considering. The problem is the antenna, and it is a mechanical rather than an electrical one. On 20 meters, for instance, a quarter-wave "whip" antenna has to be about 16 feet long. Such a rod, sticking up from a fender or bumper, would last about five miles before it became entangled with low-hanging trees, trolley wires, lamp posts, etc. For 10 meters, however, an 8-foot whip is just right; in fact, an ordinary car-radio antenna serves the purpose quite well. The 10 meter is normally a daylight band anyway, and as most driving is done at this time, about 95% of current mobile hamming is on that band. The higher frequency bands permit the use of smaller antennas, some in the form of high efficiency beams, and a lot of interesting experiments can be made with them.

Some extraordinary DX can be achieved with mobile rigs feeding inconspicuous whips. Sid Tritsch, W2NFU, whose "shack on wheels" is shown in the accompanying pictures, once worked another mobile station in California while he was driving through a forest of apartment houses in New York City. He has also worked a D4 in Germany. Although he has thirty states to his credit, he doesn't think his success is anything unusual.

From the technical standpoint, mobile is a challenging game because you are more or less limited to low transmitting power. This restriction can be traced back to the storage battery of the car, which does not have the inexhaustible source of power of your 110-volt a.c. outlet at home. The heaters of the tubes draw a few amperes, and the plate voltage unit (dynamotor or vibrator) draws more; the total load of even a modest rig can readily run to 30 or so amperes. This means that the car engine must be running at a pretty good rate, not just idling, when the station is in use.

Many hams install larger-than-usual batteries and adjust the third brush on the charging generator for maximum output, so that they can operate for short periods at least with the engine turned off. Every now and then an operator will get so engrossed in a particularly good QSO from some hill-top that he will find himself with a dead battery, and a stalled car, after an hour or so of working his rig. To call this annoying is putting it mildly!

It is highly advantageous to park in high, clear spots, but at the same time it is not advisable to race the engine of a stationary car. Many hams for this reason are buying separate gasoline-engine driven d.c. charging generators, which can be carried in the trunk compartment, hauled out and set up at the chosen location, and connected either to the car battery or an extra one. The battery more or less "floats" across the generator and remains up to snuff. A typical 40-ampere generator can run most of an



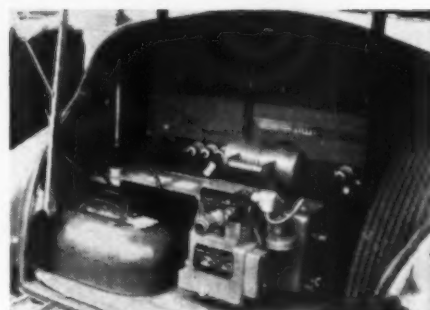
(Left) Lysco Model 129 transmitter—a three-tube unit compact enough for mounting under the car dash. All tubes are 6AG7. A separate vibrator or dynamotor is required. An identical model for 75-meter phone is also available. (Below) Lysco Model 210 converter. Covers 27 to 30 mc. A 2-meter converter is also available.



afternoon on a gallon of fuel, saving a lot of wear and tear on the car engine. Such a machine will pay for itself over a period of a year or so of active hamming.

For mobile reception, it is almost universal practice to use a converter working into the regular broadcast receiver already in the car. This draws heater current from the car's battery and plate voltage from the existing vibrator "B" supply. The unit is very small and is easily mounted on the steering column or under the dashboard, within easy reach of the driver. Of course, there is nothing to prevent you from making and installing a separate high-gain receiver, but this will certainly require more space than the converter, and you'll have trouble finding a place for it. Don't make the mistake of crowding a lot of equipment under the dashboard.

Space requirements of even small transmitters makes their placement in the trunk compartment almost mandatory. In some cars, the shelf behind the rear seat is a good spot, although the equipment then becomes rather conspicuous. Some hams manage to squeeze transmitters into the glove compartment in the front, but they still have to find power supply space.



For temporary operation of a mobile rig at a fixed location, the Onan 40-amp., 6 v. charging generator shown here in trunk compartment of a station wagon offers reliability with economy. It weighs 77 pounds and is easily handled by two men. Tub-like container on the left is gasoline can. Radio equipment on back shelf is a Motorola police job which is adapted for ten meters.

Advantages of mounting the unit in the front of the car include shortness of leads, especially the battery wires, and convenience in tuning. Disadvantages are the limited space and inaccessibility of interior parts. The large, wide-open trunk compartment offers enough space for experimental bread-board layouts, test equipment, etc.,

(Continued on page 122)


There's no mistaking this "ham shack on wheels." Sid Tritsch, of Forest Hills, N. Y., carries his call letters above his license plate. The latter, incidentally, contains his initials as well as his street number. The antenna is an 8-foot whip.





# Mac's RADIO SERVICE SHOP

By JOHN T. FRYE



A Service Sideline

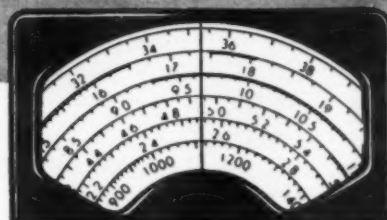
## A Service Sideline

66





# International SHORT-WAVE



Compiled by **KENNETH R. BOORD**

**I**T IS a pleasure this month to dedicate the *ISW Department* to *Radio Tahiti* (FZP8) in Papeete, Tahiti. I have just received an airmail letter-verification from G. Carisey, Le Chef du Service de l'Information, Papeete, Tahiti, in French, giving details on this new s.w. broadcaster. McPheeters, New York, received a similar letter on the same date and below I am reproducing a "composite" free translation of the two letters. Said Mr. Carisey:

"I have the honor of acknowledging receipt of your letter and am pleased to confirm that it was indeed *Radio Tahiti* that you heard.

"We began our transmissions on the 4th of July of this year with a daily transmission at 0415-0500 GMT on 12.080. This transmission, directed primarily to French Oceania, includes chiefly: 15 minutes of news in French; 15 to 20 minutes of recorded music, generally local music; and 10 to 15 minutes of news in Tahitian.

"For the time being, it is only a period of tests which we have undertaken while transforming the telegraph transmitters which we have at our disposal in Papeete. At present, important work is in progress, and we hope to have at the beginning of next year a powerful radio station which will allow us longer and more frequent transmissions on various wavelengths. These same installations will permit radiotelephony from Papeete to France, the United States, New Zealand, and Australia.

"I am particularly satisfied to know that you receive our transmissions correctly, and I would be happy if you would send me eventually your opinion of our programs and your suggestions for improving the quality of your reception.

"You may, of course, select information from this letter for use in your radio magazine.

"At this time I do not have a photograph of our installations, which are still crude, but I think I can send you in the next mail some views of the buildings under construction on the grounds of our future radio station.

"It is useless to send me an IRC and I am returning the one which you at-

tached to your letter and which I cannot use.

"I beg you to accept, sir, with my thanks, the expression of my distinguished consideration."

A penciled note enclosed (written in English) listed this data: *Call Signal—Radio Tahiti* (F.Z.P.8). *Location—Papeete, Tahiti. Frequency—12.080. Power Output—600 watts. Antenna—Rhombic* (finding direction, Paris). *Schedule—On the air daily 0415-0500 GMT (2315-2400 EST).*

From reports received by this department, *Radio Tahiti* continues to be heard fair to excellent daily throughout the United States. The station comes on the air with Hawaiian-type music. Plays various kinds of recordings—including some in English, such as cowboy ballads and some American dance tunes.

(An official of *Radio Tahiti* informed Fellers, Japan, that F08AA, "*Radio Club de Tahiti*," 6.980, was a privately-owned station which ceased operation at the end of June. I understand (via Dilg, Calif.) that, at least "back in the old days," F08AA was battery-operated and was officially listed with 200 watts. Formerly was on the air only on Tuesdays and Fridays around 2300-2345 and has not been reported lately as heard.)

Our congratulations go to *Radio*

*Tahiti* and its staff, looking forward to expansion of its services.

## Raso

From Oliver P. Ferrell, project Supervisor, Radio Amateur Scientific Observations, 121 South Broad Street, Philadelphia 7, Pennsylvania, comes this data:

"The work now being undertaken by this office is supported in part by Contract No. AP19 (122)—72 of the U. S. Air Force, through the sponsorship of the Geophysical Research Directorate, Air Material Command. We are currently collecting observations in the frequency band 50-54 mc. By observation we mean an instance of reception of a signal beyond the range of 400 miles. Since most of the DX heard beyond this range is due to sporadic-E, we are calling this program a sporadic-E observing project.

"Quite a few SWL's after reading about this project in *CQ*, volunteered their services in recording DX in this band. It struck me at that time that there must be many more SWL's who might be interested in working on this project. We are now drawing plans wherein the SWL's would be constituted as a separate section of this program."

Mr. Ferrell is interested in contact—  
(Continued on page 142)

Valuable contributor to the *ISW Department* is Grady C. Ferguson, Charlotte, N. C., shown at the listening post he has operated for 17 years. He has veries from 100 countries.



(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

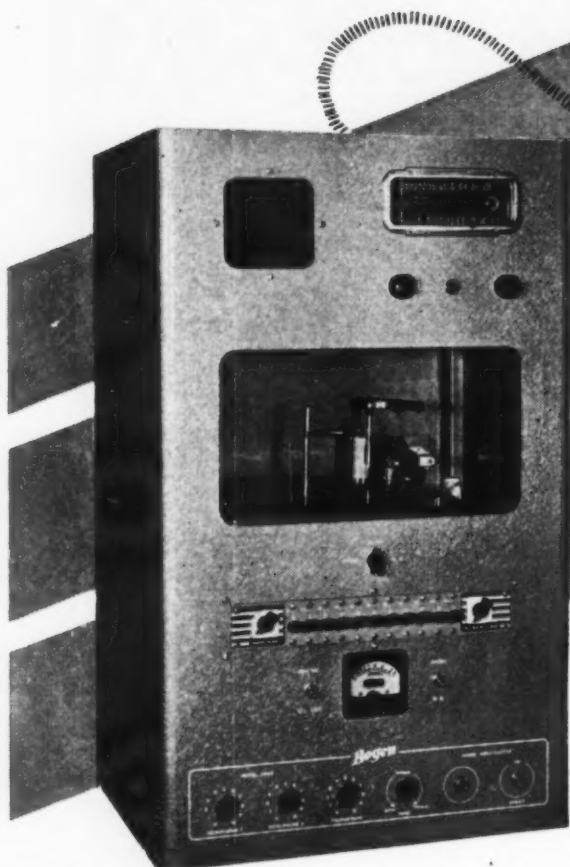


# Servicing Public Address Systems

By **JOHN B. LEDBETTER**

Engineer, WKRC-TV

*A review of the many preliminary tests which can be made to save both time and money for you and your customer.*



This Bogen SB-50 sound broadcaster has a peak output of 90 watts. It is designed for use as a centralized sound system in hospitals, factories, schools, industrial plants, resorts, large stores, etc.

**M**ANY service technicians have not investigated the possibilities offered by p.a. servicing, either because they feel insufficiently trained for this work, or because they are unable to afford a costly outlay of shop equipment. In reality, p.a. servicing requires no extensive research or specialized study; neither does it call for elaborate, expensive test instruments. The service technician who has already established himself adequately in radio receiver repair has the necessary technical knowledge, at least fundamentally, and all or most of the test equipment required to service the majority of public address systems. A few minutes spent each day in studying circuit diagrams, service manuals, and trade magazines will do much to familiarize him with the more complex circuit arrangements.

## Test Instruments Required

Test equipment should include at least a tubetester, volt-ohm-milliammeter, output meter, and audio oscillator. (Many volt-ohm-milliammeters include an output meter range as well as a db. scale).

An oscilloscope, signal tracer, and vacuum-tube voltmeter are invaluable for tracing hum, distortion, leakage, and intermittent troubles, as well as critical voltages in a.v.c., compressor, expander, limiter, and inverter

circuits. These instruments are available in the low and medium-price ranges and should be added to the shop equipment as soon as possible.

A condenser checker and vibrator tester also are handy to have around the shop.

## Preliminary Testing

Much time and trouble can be saved by adopting these rules: (1) Take nothing for granted, and (2) look for the simple things first. Although both rules should be obvious, it is surprising how often they are overlooked. Many hours have been spent checking tubes, condensers, and voltages when the trouble lay in a rosin joint or faulty connection. Not to be overlooked are those "self-serviced" amplifiers which come into the shop with connections changed, wrong replacement parts used, and tubes changed around.

Rule 1 applies equally as well to tube testing. Certain multi-element tubes, especially pentagrid converters, duo-diode triodes, and beam power output tubes are notorious for giving a satisfactory reading (particularly on emission-type testers), only to be inefficient or become totally inoperative when the normal load is applied. Trouble of this sort can show up in almost any type of tube, so play safe—double-check a suspected tube with one known to be good.

Before actual testing is begun, the apparent source of trouble should be determined as closely as possible. Once the trouble is localized or confined to a particular stage, much of the usual routine work can be eliminated.

First, inspect the line cord briefly but carefully for breaks, worn spots, poor insulation, loose connections, and for shorted strands or corroded contacts at the plug. Inspect the fuse holder for corrosion or loose blades. If the fuse is blown, check it for proper current-carrying capacity and check the transformer for evidence of overheating. A blown fuse (if its rating was correct) should not be replaced until the line cord and power transformer have been checked for internal and external shorts and grounds. If these appear to be in good condition, the amplifier should then be turned on, making sure the speaker or normal load is connected.

Next, inspect the rectifier tube for open or burned-out filament, and for red-hot plates which indicates a shorted input filter condenser. A shorted output filter is often indicated by a purple glow on the inside of each plate, surrounding the filament. Hot rectifier plates, accompanied by an overheated filter choke, could point to a shorted output filter condenser, a possible short to ground at the output side of the choke, or a shorted bypass condenser at this point. In either case, turn the amplifier off immediately to prevent further damage.

While the rest of the tubes are heating, inspect the microphone cable for apparent breaks or frayed shield and the plug for loose or defective connections. The microphone itself can be checked later. When the tubes have reached normal operating temperature, check for burned-out heaters or filaments by touching metal tubes gently, or by observing heater glow in



glass tubes. A cold tube is an almost certain indication of a burned-out filament. It is not absolute in every case, however, since loose tube prongs, a rosin joint, or broken filament supply lead at the tube socket could be responsible.

During these tests, set the gain controls approximately half-open and connect the microphone. If the amplifier is in operating condition, feedback should be experienced. The microphone cable can be checked for intermittent breaks and faulty connections by twisting and moving the cable. Broken leads usually will be found within six inches of either end, since most of the bending and strain during use takes place within this distance. If no output can be obtained from the amplifier, but normal hiss or tube noise can be heard, check the condition of the microphone and cable by substitution. If no substitutes are immediately available, a quick check can be made by inserting an open-circuit plug into the microphone input. A loud hum or pop indicates that the system from that point to the speaker is at least operative.

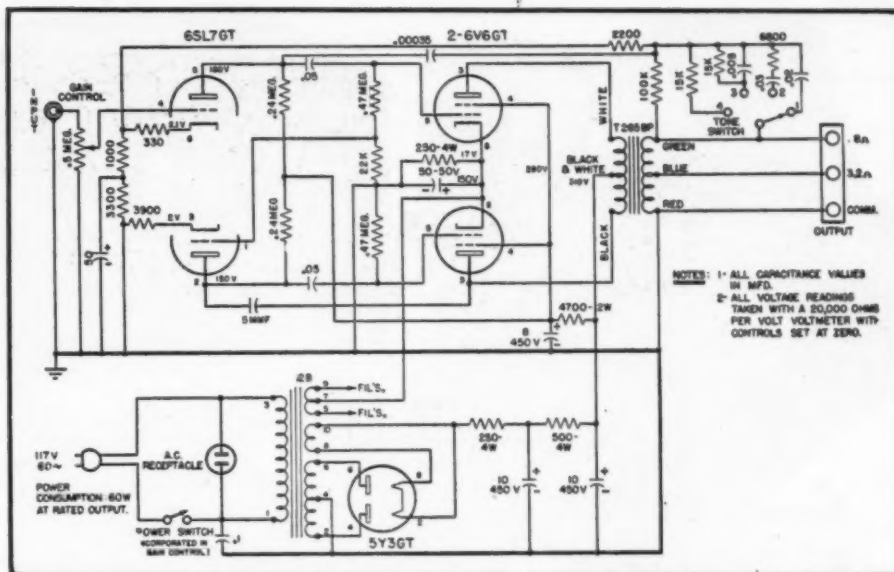
Assuming the amplifier to be inoperative at this point, proceed as follows: Start at the speaker and work back, stage by stage, toward the microphone. First, listen for hum in the speaker. A normal amount proves the field coil to be in good condition. Absence of hum could mean an open or shorted field coil or filter choke, or a shorted filter condenser. It could also be due to a lack of "B" voltage which, in turn, could be caused by a defective rectifier tube, faulty socket contacts, or an open circuit in the high-voltage secondary winding of the power transformer. Excessive hum usually means one or more open filter condensers or a shorted bias choke or resistor.

Double-check the field coil by holding a screwdriver in front of the core and noting the "pull." Use care to avoid damaging the speaker cone.

The output stage is next in line. Remove the output tubes, one by one, from their sockets. Absence of an accompanying pop denotes an open output transformer or voice coil, a shorted bypass condenser, or no "B" voltage. One of the tubes in a push-pull stage should not be removed for any length of time unless the other is also removed. The remaining tube is forced to carry twice its normal load and may become soft or gassy.

The tube in the preceding stage (usually the driver or inverter) is next removed and replaced. Absence of noise indicates no plate voltage due to an open dropping resistor or shorted bypass condenser, open or shorted coupling condensers, excessive cathode bias in the output stage (biasing these tubes past cut-off), or defective output tubes.

Each preceding stage is checked in the same manner, with a lack of noise accompanying tube removal or replacement indicating trouble in the



Service, sales, and rentals of small systems makes up a large part of the service technician's income. This is a schematic of the Bogen PH-10 (10 watts output).

plate circuit of that immediate stage, or in the grid circuit (or tube) of the following stage. A simple approximation of the loss or gain of each stage can be obtained in these tests by noting the increase in circuit "pop" as each tube is removed and re-inserted. Tubes with control grid caps can be given the same test by touching the caps with the finger or with a screwdriver.

If the trouble has been located during this preliminary checking (which usually takes less than two minutes), much time is saved in subsequent routine testing. If the trouble has not been found, the tests have by no means been wasted. The regular routine tests are simply taken up at this point.

Tubes should be tested first. In these tests the amplifier should be left on

so that the tubes will remain at normal operating temperatures. In this way leakages, intermittent shorts, and noise are more readily indicated. Both output tubes are removed and tested first; the other tubes are tested in any order, the rectifier being last. A two-fold purpose is served by this method: removing the output tubes first eliminates unnecessary noise, and the surge in "B" supply voltage as each tube is removed often will reveal leaky or intermittently shorting condensers. The amount of overload, unless abnormal conditions exist, will not be sufficient to damage condensers in good condition.

Individual tests should be made for low emission, noise, shorts, leakage, and intermittents. Tubes testing ten  
(Continued on page 188)

Deluxe control position at the camera works of the Eastman Kodak Co.







By  
**DAVID FIDELMAN**

***A complete listing of all audio test equipment manufactured, including specifications and prices.***

**O**NE of the most important factors to be considered in any type of audio engineering, construction, or operation is the selection of proper instruments and equipment to test the operation and quality of the system. With good test instruments, properly used, it is possible to obtain a reliable and accurate measurement of all the factors which are important in obtaining good reproduction of sound. The purpose of this article is to present as complete a listing as possible of all the audio test equipment available in the country—together with characteristics, specifications, prices, and information on where they can be obtained—in order to aid the audio engineer and technician in the intelligent selection of the instruments best suited to his needs.

Any type of measurement consists essentially of causing the system under test to perform its function under controlled conditions, and to measure the success with which it performs this function. The accuracy of the measurement is determined by the degree to which the input test signal represents or simulates the true operating condition, and by the accuracy with which the operation of the system and the relevant factors can be measured. Sound and audio signals

of speech and music are usually extremely complex, and therefore several different types of measurements are required to give the desired information. To obtain complete and accurate information about the quality of reproduction which can be expected from any given system, the following factors should be measured: (a) Frequency response, (b) noise level, (c) maximum output (voltage, current or power), (d) harmonic distortion at different output levels, (e) intermodulation distortion at different output levels, (f) transient response, (g) phase response, and (h) wow and flutter (in disc, film, or magnetic reproduction). All of the commercial equipment currently available for the measurement of these various factors are listed in this article.

A basic setup for any type of measurement is shown in Fig. 1. A known input signal of the proper form is applied through a signal generator of the desired impedance to the input of the system, and the resulting output is measured across the desired load impedance. Of course, measurements of the different factors listed above will

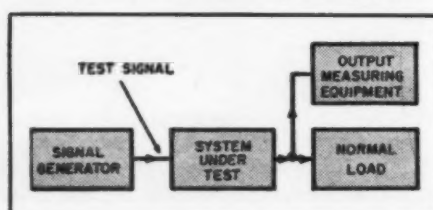
require different types of input signals and output measuring instruments. A summary of the type of input and output signals required for measuring each of the above factors, and of the specific test instruments which must be used for the measurement, is given on page 73. (The accepted limits for good reproduction are also included in this table for convenient reference when performing these measurements.) The information represents a complete summary of all the measurements of audio reproduction and the various factors which determine the quality of reproduction. The specific commercial units which may be used in these measurements are also listed in the tables.

Referring to Fig. 1, it may be seen that all audio test instruments fall into certain logical categories as follows:

- I Signal generating instruments
  - (a) Sine-wave oscillators and signal generators
  - (b) Square-wave generators
  - (c) Sine/square-wave generators
  - (d) Fixed single-frequency generators
  - (e) Sweep-frequency generators
  - (f) Generators of complex signals
- II Instruments for measurement and observation of electrical signals
  - (a) Vacuum-tube voltmeters
    - 1. For low-level signals
    - 2. For intermediate and high-level signals
  - 3. V.t.v.m.'s included in multimeters
  - (b) Oscilloscopes
  - (c) Signal tracers and test speakers
- III Instruments for measurement of sound

(Continued on page 110)

**Fig. 1. Basic setup for any type of measurement consists of applying a standard test signal to the input of the system under test and measuring the resulting response on a normal operating load.**





## AUDIO TEST EQUIPMENT MANUFACTURERS LISTED IN FOLLOWING TABLES

<b>Alfred W. Barber Laboratories</b> 34-04 Francis Lewis Blvd. Flushing, N. Y.	<b>Clarkston Corp.</b> 11927 W. Pico Blvd. Los Angeles 34, Calif.	<b>Furzehill Laboratories Ltd.</b> Boreham Wood, Herts England	<b>Lavelle Laboratories</b> Matawan-Freehold Road Morganville, New Jersey	<b>Shallcross Mfg. Co.</b> Collingdale, Pa.
<b>Allen B. Du Mont Laboratories, Inc.</b> Clifton, New Jersey	<b>Clippard Instrument Laboratory</b> 1125 Bank St. Cincinnati 14, Ohio	<b>General Electric Co. (G-E)</b> Electronics Dept. Thompson Road, Syracuse, N. Y.	<b>McMurdo Silver Co., Inc.</b> 1240 Main St. Hartford 3, Conn.	<b>Simpson Electric Co.</b> 5200 W. Kinzie St. Chicago 44, Ill.
<b>Altec-Lansing Corp.</b> 1161 North Vine St. Hollywood 38, Calif.	<b>Clough Brongle Co.</b> 6014 Broadway Chicago, Ill.	<b>General Radio Co.</b> Cambridge, Mass.	<b>Measurements Corp.</b> Boonton, New Jersey	<b>Southwestern Industrial Electronic Co.</b> P. O. Box 13058 Houston 19, Texas
<b>Amplifier Corp. of America</b> 396 Broadway New York 13, N. Y.	<b>Coastwise Electronics Co. (Ferret)</b> 130 N. Beaudry Ave. Los Angeles 12, Calif.	<b>Heath Company</b> Benton Harbor, Mich.	<b>Panoramic Radio Products, Inc.</b> 10 S. Second Ave. Mount Vernon, N. Y.	<b>Superior Instruments Co.</b> 277 Fulton St. New York 7, N. Y.
<b>Audio Instrument Co.</b> 1947 Broadway New York 23, N. Y.	<b>Daven Company</b> 191 Central Ave. Newark 4, New Jersey	<b>Hewlett-Packard Co.</b> 395 Page Mill Road Palo Alto, Calif.	<b>Pickering &amp; Co., Inc.</b> 309 Woods Ave. Oceanside, N. Y.	<b>Supreme, Incorporated</b> Greenwood, Miss.
<b>Ballantine Laboratories, Inc.</b> Boonton, New Jersey	<b>Dealittle Radio, Inc.</b> 7421 S. Loomis Blvd. Chicago 36, Ill.	<b>Hickok Electrical Instrument Co.</b> 10514 Dupont Ave. Cleveland 8, Ohio	<b>Precision Apparatus Co.</b> 92-27 Horace Harding Blvd. Elmhurst, N. Y.	<b>Sylvania Electric Products, Inc.</b> Emporium, Pa.
<b>Barker &amp; Williamson, Inc.</b> 235 Fairfield Ave. Upper Darby, Pa.	<b>Electrodyn Co.</b> 899 Boylston St. Boston 15, Mass.	<b>Instrument Electronics</b> 45-17 Glenwood St. Little Neck, N. Y.	<b>Progressive Electronics Co.</b> 497 Union Ave. Brooklyn 11, N. Y.	<b>Technology Instrument Corp.</b> 1058 Main St. Waltham, Mass.
<b>Beta Electronics Co.</b> 1762 Third Ave. New York 29, N. Y.	<b>Electronic Designs, Inc.</b> Irvington, N. Y.	<b>Jackson Electrical Instrument Co.</b> 18 S. Patterson Blvd. Dayton 1, Ohio	<b>Radio City Products Co.</b> 152 W. 25th St. New York 1, N. Y.	<b>Times Facsimile Corp.</b> 229 W. 43rd St. New York 18, N. Y.
<b>Boonton Radio Corp.</b> Boonton, New Jersey	<b>Electronic Instrument Co. Inc.</b> 276 Newport St. Brooklyn 12, N. Y.	<b>James Millen Mfg. Co.</b> 150 Exchange St. Malden 48, Mass.	<b>Radio Corp. of America (RCA)</b> RCA Victor Division Harrison, New Jersey	<b>Tektronix, Inc.</b> 712 S.E. Hawthorne Blvd. Portland 14, Oregon
<b>Brown Electro-Measurement Corp.</b> 4635 S. E. Hawthorne Blvd. Portland 15, Oregon	<b>Electronic Tube Corp.</b> 1200 E. Mermaid Lane Philadelphia 18, Pa.	<b>John Fluke Engineering Co.</b> Box 755Y Springdale, Conn.	<b>Radio Supply &amp; Engineering Co.</b> 89 Selden Ave. Detroit 1, Mich.	<b>Triplet Electrical Instrument Co.</b> Bluffton, Ohio
<b>Brush Development Co.</b> 3405 Perkins Ave. Cleveland 14, Ohio	<b>Feiler Engineering Co.</b> 945 W. George St. Chicago 14, Ill.	<b>Kalbfell Laboratories, Inc. (Key-Lab)</b> 1076 Moreno Blvd. San Diego 10, Calif.	<b>Reiner Electronics Co.</b> 152 W. 25th St. New York 1, N. Y.	<b>Waterman Products Co.</b> 2445 Emerald St. Philadelphia 25, Pa.
<b>Central Scientific Co. (Cenco)</b> 1700 Irving Park Road Chicago 13, Ill.	<b>Ferret (See Coastwise Electronics)</b>	<b>Key Electric Co.</b> 14 Maple Ave. Pine Brook, New Jersey	<b>ScoH, Inc.</b> 385 Putnam Ave. Cambridge 39, Mass.	<b>Weinschel Engineering Co.</b> 123 William St. New York 7, N. Y.
<b>Cinema Engineering Co.</b> 1510 W. Verdugo Ave. Burbank, Calif.	<b>Furst Electronics</b> 12 S. Jefferson St. Chicago 6, Ill.	<b>Kelthley Instruments</b> 1507 Warrensville Center Road Cleveland 21, Ohio		<b>Western Electric Co.</b> 195 Broadway New York 7, N. Y.

## SUMMARY OF METHODS AND EQUIPMENT USED IN MEASURING THE VARIOUS FACTORS WHICH DETERMINE THE QUALITY OF AUDIO REPRODUCTION

Response or distortion being measured	Input signal		Output signal		Acceptable limits	
	Type of signal	Type of signal generator	Type of signal	Type of measuring equipment	Good reproduction	Acceptable reproduction
Frequency response	Sine wave	Sine wave generator	Sine wave	V.T.V.M. or oscilloscope	20-14,000 c.p.s.	40-10,000 c.p.s.
Maximum output	Sine wave	Sine wave generator	Sine wave	V.T.V.M.	Depends upon size of listening room	
Noise level	Zero	—	Random noise & hum	V.T.V.M.	—60 db. (below full output)	—50 db. (below full output)
Harmonic distortion	Sine wave	Sine wave generator	Fundamental plus harmonics	Distortion analyzer	2% total harmonics	2-5% total harmonics
Intermodulation distortion	Sum of high frequency and low frequency sine waves	Intermodulation composite signal generator	Amplitude modulated sine wave	Intermodulation analyzer	5%	10%
Transient response	Square wave	Square wave generator	Square wave	Oscilloscope	No set standards	
Phase response	Sine wave	Oscilloscope (Horizontal amplifier)	Sine wave	Oscilloscope (Vertical amplifier)	No set standards	
Wow & flutter	Steady sine wave	Sine wave generator	Frequency-modulated sine wave	Wow & flutter meter	0.1%	1.0%

### "WOW" METERS

Manufacturer	Type number	Test frequency	WOW range (full scale defl.)	Response rate	Required input volts	Input impedance	Price
Amplifier Corp.	—	3000 c.p.s.	0.3% to 3%	0-200 c.p.s.	1 mv. 100 v.	500,000 $\Omega$	\$660
Brush	BE-904	Any in range 500-1250 c.p.s.	0.1% to 5%	0.5-200 c.p.s.	6 milliwatts	250/750/1500 $\Omega$	\$1617.64
Furst	115-R	1000 c.p.s.	0.5% to 2%	0.5-120 c.p.s.	0.1-250 v.	1.0 meg.	\$685



### INSTRUMENTS FOR MEASUREMENT OF SOUND

Type of unit	Manufacturer	Type number	Characteristics	Price
Condenser microphones (sound standard)	Western Electric	640-AA	Cylindrical shape, 1" diam. x 1" long Capacity 50-60 $\mu$ fd. Calibrated frequency response curve—smooth; response from 50 to 15,000 c.p.s.	—
	Altec-Lansing	21-B	Cylindrical, 0.6" diameter Frequency response flat $\pm 1$ db. Capacity 20 $\mu$ fd.	\$190
Sound level meters	General Radio	759-B	Calibrated from 24 db.-140 db. above standard ASA ref. level of 0.0002 dynes/cm <sup>2</sup> . Freq. char.—all three standard ASA curves: 40 db., 70 db., and flat Two meter speeds: slow and fast Calibration accuracy $\pm 1$ db.	\$320
	H. H. Scott	410-A	Calibrated from 34 db.-140 db. above standard 0.0002 dynes/cm <sup>2</sup> . Freq. char.—all three standard ASA curves: 40 db., 70 db., and flat Two meter speeds: slow and fast Calibration accuracy $\pm 1$ db.	\$249
Artificial ear	Ballantine	505	For measuring freq. response and efficiency of telephone receivers. To be used with V.T.V.M.	—

### UNIVERSAL IMPEDANCE BRIDGES

Manufacturer	Type Number	Frequency (Internal gen.)	Range of Measurement			Accuracy	Price
			R	L	C		
General Radio	650-A	1000 c.p.s.	0.001 $\Omega$ -1 meg.	1 $\mu$ hy.-100 hy.	1 $\mu$ fd.-100 $\mu$ fd.	1%, 2%	\$240
Brown	250-A	1000 c.p.s.	0.001 $\Omega$ -1 meg.	1 $\mu$ hy.-100 hy.	1 $\mu$ fd.-100 $\mu$ fd.	0.5%-2%	\$240
	275-B	1000 c.p.s.	0.001 $\Omega$ -1 meg.	1 $\mu$ hy.-100 hy.	1 $\mu$ fd.-100 $\mu$ fd.	0.1%-1%	\$495
Construction kit: Heath	—	1000 c.p.s.	0.01 $\Omega$ -10 meg.	10 $\mu$ hy.-100 hy.	10 $\mu$ fd.-100 $\mu$ fd.	—	\$69.50

### AUDIO SIGNAL TRACERS

Manufacturer	Model Number	Type of Unit	Price
Ferret	721	Test speaker	\$29.95
	730	Signal tracer and voltohmmeter	\$99.95
McMurdo Silver	910	Test speaker	\$22.70
	905-A	Signal tracer and test speaker	\$44.50
Philco	7030	Signal tracer	\$52.50
Precision Electronics	201	Signal tracer	\$34.50
	251	Signal tracer and meter	\$49.75
Radio City Prod.	777	Signal tracer and meter	\$41.50
Superior	CA-12	Signal tracer and meter	\$29.95 Also in kit form: \$21.95
Supreme	688	Signal tracer and voltohmmeter	\$149.50
Electronic Instr. Co.	113-A	Signal tracer and voltohmmeter	\$69.95
<b>CONSTRUCTION KITS:</b>			
Heath	—	Signal tracer and test speaker	\$19.50
Electronic Instr. Co.	145	Signal tracer	\$18.95
Feiler	TS-3	Signal tracer	\$27.20
	TS-2	Signal tracer	\$23.80
	TS-5	Signal tracer	\$24.15
	TS-1	Signal tracer	\$7.65



## SQUARE-WAVE GENERATORS AND ELECTRONIC SWITCHES

Manufacturer	Type Number	Repetition Freq. Range c.p.s.	Signal Amplifier Freq. Range	Input Imp. (electr. sw.)	Output Voltage	Output Impedance	Ampl. Gain (electr. sw.)	Rise Time	Price
Reiner	530 <sup>(3)</sup>	10-100,000	—	—	20 P-P max.	0-2000 $\Omega$	—	0.3 $\mu$ sec.	\$ 90
General Electric (see Note 1)	YGL-1 <sup>(3)</sup>	5-125,000	—	—	75 P-P max.	20 ohms/volt	—	0.3 $\mu$ sec.	\$225
Tektronix	104 <sup>(3)</sup>	Four fixed: 50, 1000, 100,000, 1 mc.	—	—	50 P-P max. 5 P-P max.	0-20,000 $\Omega$ 0-93 $\Omega$	—	3 $\mu$ sec. 0.015 $\mu$ sec.	\$195
Measurements	71 <sup>(3)</sup>	6-100,000	—	—	75 P-P max.	20 ohms/volt	—	0.2 $\mu$ sec.	\$310
Lavoie	LA-583-A <sup>(3)</sup>	20-100,000	—	—	60 P-P max.	1000 $\Omega$ bal.	—	0.3 $\mu$ sec.	\$250
Hewlett-Packard	210-A <sup>(3,4)</sup>	20-10,000	—	—	50 P-P max.	1000 $\Omega$ bal.	—	1 $\mu$ sec.	\$150
DuMont	185-A <sup>(4)</sup>	10-2000	0-25,000 c.p.s.	100,000 $\Omega$	Sine 75 Sq. W. 30	50,000 $\Omega$	10 max.	25 $\mu$ sec.	\$105
Cenco	80600 <sup>(4)</sup>	500-3000	—	100,000 $\Omega$	—	22,000 $\Omega$	14	—	\$ 85

Notes: (1) Pulse characteristic: rectangular wave 75% positive, 25% negative pulse. (2) Requires 2 volts sine wave input driving signal.

(3) Square wave generator. (4) Electronic switch.

## SINE-WAVE SIGNAL GENERATORS

Manufacturer	Type No.	Class	Frequency range	Output		Output impedance	Distortion	Accuracy of calibration	Frequency drift	Output variation	Hum and noise level	Price
				Matched load	Open-circuit volts							
General Radio	913-C	Beat-frequency	20-20,000 c.p.s.	0.3 watt	25	600 $\Omega$ bal./unbal.	0.25% 1%	$\pm(1\% + 0.5 \text{ c.p.s.})$	7 c.p.s. 1st hour zero later	$\pm 0.25 \text{ db.}$	-60 db.	\$450
	1301-A <sup>(2)</sup>	R-C Push-button	20-15,000 (27 fixed freq.)	18 mw. 100 mw.	6.6 30	600 $\Omega$ bal./unbal. 5000 $\Omega$ unbal.	0.1%	$\pm(1.5\% + 0.1 \text{ c.p.s.})$	0.02% per hr.	$\pm 1 \text{ db.}$	—	\$395
	1302-A	R-C	10-100,000 c.p.s.	40 mw. 20 mw. 80 mw.	10 5 20	600 $\Omega$ bal. 300 $\Omega$ unbal. 5000 $\Omega$ unbal.	1%	$\pm(1.5\% + 0.2 \text{ c.p.s.})$	1% 1st 10 min. 0.2% after	$\pm 1 \text{ db.}$	-60 db. <sup>(1)</sup>	\$365
Hewlett-Packard	200-A	R-C	35-35,000 c.p.s.	1 w.	25	500 $\Omega$ unbal.	1%	—	Greater of: 2% or 0.2 c.p.s.	$\pm 1 \text{ db.}$	-60 db. <sup>(1)</sup>	\$120
	200-B	R-C	20-20,000 c.p.s.	1 w.	25	500 $\Omega$ unbal.	1%	—	2% or 0.2 c.p.s.	$\pm 1 \text{ db.}$	-60 db. <sup>(1)</sup>	\$150
	200-C	R-C	20-200,000 c.p.s.	100 mw.	—	1000 $\Omega$ unbal.	1%	—	2% or 0.2 c.p.s.	$\pm 1 \text{ db.}$	-60 db. <sup>(1)</sup>	\$175
	200-D	R-C	7-70,000 c.p.s.	100 mw.	—	1000 $\Omega$ unbal.	1%	—	2% or 0.2 c.p.s.	$\pm 1 \text{ db.}$	-60 db. <sup>(1)</sup>	\$225
	200-I	R-C	6-6000 c.p.s.	100 mw.	—	1000 $\Omega$ unbal.	1%	1%	2% or 0.2 c.p.s.	$\pm 1 \text{ db.}$	-60 db. <sup>(1)</sup>	\$250
	201-B	R-C	20-20,000 c.p.s.	3 w/1 w.	50	600 $\Omega$	1%/0.5%	—	2%, 1%	$\pm 1 \text{ db.}$	-60 db.	\$250
	204-A	R-C	2-20,000 c.p.s.	5 v.	—	10,000 $\Omega$	1%	—	—	—	—	\$175
	202-D	R-C	2-70,000 c.p.s.	100 mw.	—	1000 $\Omega$ unbal.	1%	—	2% or 0.2 c.p.s.	$\pm 1 \text{ db.}$	-60 db. <sup>(1)</sup>	\$275
	205-A <sup>(3)</sup> 205-AG <sup>(4)</sup>	R-C	20-20,000 c.p.s.	5 w.	—	50 $\Omega$ , 200 $\Omega$ , 600 $\Omega$ , 5000 $\Omega$ bal./unbal.	1%	—	2%, 1%	$\pm 1 \text{ db.}$	-60 db. to -90 db.	\$390 \$425
RCA	WA-54A	Beat-frequency	20-17,000 c.p.s.	125 mw.	40 2.5	250 $\Omega$ , 500 $\Omega$ , 5000 $\Omega$ bal.	5% 3%	—	—	$\pm 2 \text{ db.}$	-60 db. <sup>(1)</sup>	\$152.50
	68-B	BFO	20-17,000 c.p.s.	125 mw.	—	250/500/5k $\Omega$ bal.	0.3%	$\pm 1\%$ or 1 c.p.s.	—	$\pm 1 \text{ db.}$	-70 db. <sup>(1)</sup>	\$718.75
Sylvania	145	R-C	20-20,000 c.p.s.	1 w.	—	8 $\Omega$ , 15 $\Omega$ , 500 $\Omega$ unbal.	2%	$\pm 2\%$ or $\pm 1 \text{ c.p.s.}$	—	$\pm 2 \text{ db.}$	-60 db. <sup>(1)</sup>	\$129.50
Furzehill	2232 <sup>(3)</sup>	Beat-frequency	20-20,000 c.p.s.	10 v.r.m.s.	—	600 $\Omega$ unbal.	0.5%	$\pm 1\%$ $\pm 2 \text{ c.p.s.}$	5 c.p.s. per day after 1/2 hr.	$\pm 1 \text{ db.}$	-50 db. <sup>(1)</sup>	—
Weinschel	150-AO	—	0.3-100,000 c.p.s. decade push-buttons	—	—	—	0.5%	0.5% $\pm 0.2 \text{ c.p.s.}$	0.02% per hr. after 1/2 hr.	—	—	\$950
Southwestern Industrial Electronic Co.	M	R-C	1-120,000 c.p.s.	400 mw.	20	—	0.2%	1.5% $\pm 0.1 \text{ c.p.s.}$	0.5%	$\pm 0.5 \text{ db.}$	-75 db.	\$387.50
Barker & Williamson	200	R-C	30-30,000 c.p.s.	250 mw.	12.5	500 $\Omega$	1%	$\pm 2.5\%$	1%	$\pm 1 \text{ db.}$	—	\$115
Clough-Brengle	179-A	BFO	25-15,000 c.p.s.	100 mw.	35	600 $\Omega$ unbal.	5%	2% or 5 c.p.s.	—	$\pm 1 \text{ db.}$	-54 db.	\$ 95
	280-A	BFO	25-32,000 c.p.s.	100 mw.	—	600 $\Omega$ bal. 4000 $\Omega$ unbal.	0.5%	2% or 5 c.p.s.	—	$\pm 1 \text{ db.}$	-60 db.	\$275
Jackson	655	R-C	20-200,000 c.p.s.	500 mw.	—	10 $\Omega$ , 250 $\Omega$ 500 $\Omega$ , 5k $\Omega$	5%	3% or 1 c.p.s.	—	$\pm 1 \text{ db.}$ (30-15k c.p.s.)	-60 db. <sup>(1)</sup>	\$135
Supreme	680	BFO	15-15,000 c.p.s.	500 mw.	65	250/500/5k $\Omega$ bal.	5%	—	—	$\pm 1 \text{ db.}$	—	\$ 82.95

Notes: (1) Below full output. (2) Range can be extended to 2 C.P.S. (3) Contains vacuum-tube voltmeter to read output voltage. (4) Contains two vacuum-tube voltmeters for complete gain measurements.



### DECADE AMPLIFIERS AND HIGH INPUT IMPEDANCE TRANSFORMERS

Type of Unit	Manufacturer	Type Number	Input Impedance	Output Impedance	Voltage Gain	Frequency Range	Price
Impedance transformer and decade ampl.	Keithley	102	200 meg., 6.2 $\mu$ fd.	300 $\Omega$	1/10/100	5 c.p.s.-150 kc.	\$175
Impedance transformer	Audio Instr. Co.	100	100 meg., 6 $\mu$ fd.	200 $\Omega$	1	over 10 kc.	\$72.50
Decade amplifier	Ballantine	220	1 meg.	1500-3000 $\Omega$	10/100	10 c.p.s.-100 kc.	\$90
	Hewlett-Packard	450-A	1 meg., 15 $\mu$ fd.	150 $\Omega$	10/100	10 c.p.s.-1 mc.	\$140
	Kay-Lab.	102-A	3 meg., 10 $\mu$ fd.	10 $\Omega$	100/1k/10k	10 c.p.s.-100 kc.	\$175
	Reiner	101	—	—	100	10-5000 c.p.s.	\$45

### FREQUENCY METERS

Manufacturer	Type number	Principle of operation	Frequency range	Input impedance	Accuracy	Price
Hewlett-Packard	500-A	Electronic measurement	5-50,000 c.p.s.	50,000 $\Omega$	2%	\$210
Barker & Williamson	300	Electronic measurement	20-30,000 c.p.s.	—	2%	\$105
General Radio	1141-A	Tuned R-C bridge	20-20,000 c.p.s.	3000-10,000 $\Omega$	0.5%	\$215
Kay-Lab	601-A	Heterodyne	500 c.p.s.-50 mc.	—	—	\$125
Daven	838-A	Electronic measurement	20-100,000 c.p.s.	High	2%	\$300

### SINE AND SQUARE-WAVE GENERATORS

Manufacturer	Type No.	Class	Frequency Range c.p.s.	Output		Output Impedance	(Sine-wave) Distortion	Accuracy of Calibration	Output Variation	Price
				Open-circuit Volts	Matched Load					
McMurdo Silver	913	R-C	20-25,000	60	1 w.	6/125/500/5k $\Omega$ 500 $\Omega$ bal.	1%	$\pm 1\%$ or $\pm 1$ c.p.s.	—	\$68.50
Ferret	701	R-C	20-24,000	15	—	—	—	2%	—	\$89.95
Radio City Prod.	711	R-C	10-100,000	15	—	—	—	—	—	\$87.50
Cenco	80592	R-C	20-20,000	25	60 mw.	500 $\Omega$ unbal.	—	$\pm 3\%$ or 3 c.p.s.	$\pm 2$ db.	\$100
Construction Kit: Heath		R-C	20-20,000	—	—	—	1%	—	$\pm 1$ db.	\$34.50

### CALIBRATED ATTENUATORS

Manufacturer	Type Number	Input Impedance	Load Impedance	Attenuation Range	Minimum Attenuation Step	Attenuation Accuracy	Price
General Radio	546-C(1)	600 $\Omega$	100k $\Omega$	0-146 db.	Continuous	$\pm (0.3\% + 0.5\mu\text{v.})$	\$110
	654-A	10k $\Omega$	1 meg.	0.001-1.0	0.001	$\pm 0.2\%$	\$100
	1450	600 $\Omega$	600 $\Omega$	0-110 db.	1 db.	$\pm 1\%$	—
Hewlett-Packard	350 A/B	500/600 $\Omega$	500/600 $\Omega$	0-110 db.	1 db.	—	\$50
Furzehill	1353	600 $\Omega$	600 $\Omega$	0-110 db.	1 db.	0.1 db.	—
Daven	690 Series	500/600 $\Omega$	500/600 $\Omega$	0-110 db.	1 db.	—	\$80 and \$100
	692	500 $\Omega$	500 $\Omega$	0-111 db.	0.1 db.	—	\$110 and \$130
	693	600 $\Omega$	600 $\Omega$				
	694	135 $\Omega$	135 $\Omega$				
Shallcross	355	600 $\Omega$	600 $\Omega$	0-35 db.	5 db.	—	\$35
Keithley	101	11k $\Omega$	30k $\Omega$	0.0001-1.0	Decode	2%-4%	\$10.50

Note: (1) Contains meter for measuring input voltage.



### OSCILLOSCOPES WITH GREATER THAN 1 MC. BANDWIDTH

Size of C-R Tube	Manufacturer	Type Number	Signal Freq. Range	Defl. sens. (R.M.S. v/in.)		Sweep Frequencies	Input Impedance	Price
				Vertical	Horizontal			
5"	DuMont	241	20 c.p.s.- 4 mc.	0.07	0.7	15-30,000 c.p.s.	2 meg., 40 $\mu$ fd.	\$ 458
		248-A	20 c.p.s.- 5 mc.	0.1	2.75	15-150,000 c.p.s.	1 meg., 40 $\mu$ fd.	\$1870
	RCA	WO-58A	5 c.p.s.- 2 mc.	0.2	0.7	10-100,000 c.p.s.	1 meg., 25 $\mu$ fd.	\$ 431.25
		715-B	5 c.p.s.-11 mc.	0.06	0.3	5-100,000 c.p.s.	1 meg., 40 $\mu$ fd.	\$3000
	Reiner	556	10 c.p.s.- 2 mc.	0.05	0.05	to 1 mc.	10 meg., 25 $\mu$ fd.	\$ 455
	Supreme	660	5 c.p.s.- 5 mc.	0.1	0.14	7-100,000 c.p.s.	5 meg., 5 $\mu$ fd.	\$ 276.80
	Tektronix	511-A	5 c.p.s.-10 mc.	0.65	—	—	1 meg., 40 $\mu$ fd.	\$ 795
		512	d.c.-2 mc.	0.375	—	—	1 meg., 40 $\mu$ fd.	\$ 950
3"	Lavoie	LA-239A	10 c.p.s.- 5 mc.	0.06	—	—	0.3 meg., 30 $\mu$ fd.	\$1950
	Reiner	524	20 c.p.s.- 2 mc.	0.1	0.7	15-30,000 c.p.s.	2 meg., 30 $\mu$ fd.	\$ 275
	DuMont	224-A	20 c.p.s.- 2 mc.	0.1	0.7	15-30,000 c.p.s.	2 meg., 30 $\mu$ fd.	\$ 290
	Furzehill	1684 D/2	d.c.-3 mc.	0.015-0.045	0.03-0.09	2-150,000 c.p.s.	1 meg., 60 $\mu$ fd.	\$ 895
	RCA	WO-79A	10 c.p.s.- 5 mc.	0.17	0.43	20-250,000 c.p.s.	1 meg. 30 $\mu$ fd.	\$ 687.50

### MULTIPLE BEAM OSCILLOSCOPES

Manufacturer	Type Number	Number of Beams	Signal Freq. Range	Defl. sens. (R.M.S. v/in.)		Sweep Frequencies	Input Impedance	Price
				Vertical	Horizontal			
DuMont	279	2	d.c.-200,000 c.p.s.	0.35	0.35	2-30,000 c.p.s.	2 meg., 60 $\mu$ fd.	\$1300
Electronic Tube Corp.	H-21	2	d.c.-200,000 c.p.s.	0.035	0.26	2-50,000 c.p.s.	—	\$1285
	H-43	4	d.c.-200,000 c.p.s.	0.35	—	—	—	\$1995

### MISCELLANEOUS MEASURING AND ACCESSORY INSTRUMENTS

Type of unit	Manufacturer	Type number	Characteristics	Price
Noise generator	H. H. Scott	810-A	Random noise source—equal power in equal frequency bands 20-20,000 c.p.s. (and to over 200,000 c.p.s.) Output 0-0.2 volts	\$42.50 (or \$70)
Complex wave generator	Barber	57	Fundamental and harmonics of variable phase Fund: 50-3000 c.p.s. Harmonics: 2nd-5th; 0-100%; 0 to $\pm 180^\circ$ phase Output: 1 volt fundamental	\$495
Linear to logarithmic amplitude char. converter	Kay-Lab	510	Output proportional to logarithm of input voltage from 0.04 v.-15 v. Impedance 10,000 $\Omega$	\$49
	Audio Instr. Co.	121	Combines a linear-to-logarithmic converter with a V.T.V.M. Freq. range: 25-20,000 c.p.s. Meter range: 50 db. Input: 100,000 $\Omega$ unbalanced 0.1 volts for full-scale defl.	—
Impedance meter	Electrodyne	Impedometer	Used with oscillator and V.T.V.M. to measure impedance on scale of V.T.V.M. Range: 0.1-100,000 ohms	\$34.50
Angle meter	Technology Instrument	310-A	Freq. range: 30-20,000 c.p.s. Range: R—0.5 to 100k ohms L—5 $\mu$ hy. to 500 hy. C—0.0012 to 10,000 $\mu$ fd. Phase angles: $0^\circ$ to $\pm 90^\circ$ Self-contained V.T.V.M.	—
Phase meter		320-A	Freq. range: 20 c.p.s.-100 kc. Voltage range: 1-170 v. peak Phase angle ranges: 0-36°, 90°, 180°, 360° Accuracy: larger of 2-3% or 3-5 c.p.s.	\$475
Vacuum-tube volts-amperes-watts meter	Fluke Eng. Co.	101 VAW meter	Inserted into output circuit. Freq. range: 20-200,000 c.p.s. Voltage range: 0.1-300 v. Current range: 1.0 ma.-300 amps. Power: reads VA cos $\phi$ Accuracy: $\pm 3\%$	\$695



# OSCILLOSCOPES UP TO 1 MC. BANDWIDTH (3 DB. AT 1 MC.)

Size of C-R Tube	Manufacturer	Type Number	Signal Freq. Range	Defl. Sens. (R.M.S. v/in)		Sweep Frequencies	Input Impedance	Price
				Vertical	Horizontal			
Projection (12"x16")	Beta Electronics	701	7 c.p.s.-125 kc.	0.06	0.065	7-7000 c.p.s.	1 meg., 25 $\mu$ fd.	\$645-\$695
7"	Sylvania	132	10 c.p.s.- 70 kc.	0.21	0.25	15- 30,000 c.p.s.	0.5 meg., 26 $\mu$ fd.	\$144.50
5"	DuMont	274(I)	20 c.p.s.- 50 kc.	0.65	0.65	8- 30,000 c.p.s.	1 meg., 40 $\mu$ fd.	\$136.50
		208-B	2-100,000 c.p.s.	0.01	0.5	2- 50,000 c.p.s.	2 meg., 30 $\mu$ fd.	\$285
		250	0-200,000 c.p.s.	0.015	0.7	1-150,000 c.p.s.	2 meg., 40 $\mu$ fd.	\$635
	RCA	WO-60-C(I)	2-100,000 c.p.s.	0.020	0.024	3- 30,000 c.p.s.	1 meg., 22 $\mu$ fd.	\$431.25
		WO-27-A(I)	0-100,000 c.p.s.	0.03	0.035	0-100,000 c.p.s.	0.5 meg.	\$1437.50
	Reiner	550-A	5-500,000 c.p.s.	0.03	—	4- 22,000 c.p.s.	70k $\Omega$ , 38 $\mu$ fd.	\$187.50
		508	2-100,000 c.p.s.	0.01	0.5	2- 50,000 c.p.s.	2 meg., 30 $\mu$ fd.	\$265
	G-E	ST-2A	0-500,000 c.p.s.	0.015	0.35	10-100,000 c.p.s.	1 meg., 36 $\mu$ fd.	\$279.50
	Cenco	71552	10-300,000 c.p.s.	1.0	1.0	10- 60,000 c.p.s.	0.5 meg., 20 $\mu$ fd.	\$135
	Hickok	505-A	30 c.p.s.-1 mc.	0.03	0.2	10- 25,000 c.p.s.	1 meg., 25 $\mu$ fd.	\$298.33
		195-B	30 c.p.s.-1 mc.	0.03	0.15	—	1 meg., 25 $\mu$ fd.	\$260
	Millen	90905	15-125,000 c.p.s.	—	—	15- 40,000 c.p.s.	—	—
	Precision	ES-500	10 c.p.s.-1 mc.	0.02	0.5	10- 30,000 c.p.s.	2 meg., 22 $\mu$ fd.	\$149.50
	Supreme	655	20-100,000 c.p.s.	0.3	0.3	20- 30,000 c.p.s.	—	\$126.50
	Triplet	3440	20 c.p.s.-1 mc.	0.02	0.2	10- 60,000 c.p.s.	2 meg., 25 $\mu$ fd.	—
3"	DuMont	164-E(I)	5-100,000 c.p.s.	0.8	0.65	15- 30,000 c.p.s.	1 meg., 40 $\mu$ fd.	\$127.20
	RCA	WO-55-A(I)	7- 70,000 c.p.s.	1.33	1.5	15- 50,000 c.p.s.	0.5 meg., 55 $\mu$ fd.	\$129.50
	G-E	YNA-4(I)	0- 50,000 c.p.s.	0.18	0.21	10- 20,000 c.p.s.	1 meg., 10 meg., and open grid	\$189.50
	Sylvania	131(I)	10-100,000 c.p.s.	0.5	0.5	15- 40,000 c.p.s.	1 meg., 30 $\mu$ fd.	\$ 89.50
	Cenco	71551	10-300,000 c.p.s.	1.0	1.0	10- 60,000 c.p.s.	0.5 meg., 20 $\mu$ fd.	\$ 95.75
	Millen	90903	15-125,000 c.p.s.	—	—	15- 40,000 c.p.s.	—	—
	Supreme	65J	20-100,000 c.p.s.	0.5	0.5	20- 30,000 c.p.s.	—	\$ 99.95
	Radio City Prod.	90	5-200,000 c.p.s.	0.285	0.320	10- 45,000 c.p.s.	1 meg., 20 $\mu$ fd.	\$127.50
	Radio Supply & Eng.	AR-3	to 1 mc.	—	—	—	—	\$ 49.95
	Furzehill	1936-A	1-20,000 c.p.s.	0.02	0.375	5- 10,000 c.p.s.	1 meg., 40 $\mu$ fd.	\$360
		1684-N	0- 50,000 c.p.s.	0.0025	0.1	5- 10,000 c.p.s.	2.2 meg., 25 $\mu$ fd.	—
		1684-K(I)	0-300,000 c.p.s.	0.001	0.002	0.3- 60,000 c.p.s.	2 meg.	—
	Waterman	S-11-A(I)	0-200,000 c.p.s.	0.1	0.1	3- 50,000 c.p.s.	0.5 meg., 35 $\mu$ fd.	—
		S-12-A(I)	0-200,000 c.p.s.	0.05	0.05	0.5- 50,000 c.p.s.	0.5 meg., 35 $\mu$ fd.	—
2"	Philco	7019	20-100,000 c.p.s.	1.0	1.0	10- 50,000 c.p.s.	0.5 meg., 36 $\mu$ fd.	\$ 66
	Millen	90952	10 c.p.s.-1 mc.	0.35	—	16- 22,000 c.p.s.	—	—
		90902	15-125,000 c.p.s.	—	—	15- 40,000 c.p.s.	—	—
	Waterman	S-10-A	20-100,000 c.p.s.	1.0	1.0	10- 50,000 c.p.s.	0.5 meg., 36 $\mu$ fd.	—
		S-10-B(I)	20-150,000 c.p.s.	1.0	1.0	10- 50,000 c.p.s.	0.5 meg., 36 $\mu$ fd.	—
CONSTRUCTION KITS:								
5"	Electronic Instr. Co.	400	50- 50,000 c.p.s.	0.65	0.65	15- 30,000 c.p.s.	—	\$ 39.95
	Feiler	TS-7	20-350,000 c.p.s.	0.5	0.5	10- 32,000 c.p.s.	1 meg., 50 $\mu$ fd.	\$ 75.50
	Heath	—(I)	2 mc.	0.06	0.06	15- 70,000 c.p.s.	1 meg., 50 $\mu$ fd.	\$ 39.50

Note: (I) Identical vertical and horizontal amplifiers.



### FREQUENCY STANDARDS AND TONE GENERATORS

Manufacturer	Type No.	Frequency	Accuracy	Maximum Output	Output Impedance	Price	Class
General Radio	723	3 models: 400, 440, or 1000 c.p.s.	$\pm 0.05\%$	50 mw.	50/500/5k $\Omega$	\$115 to \$150	Tuning-fork
	813-A	1000 c.p.s.	0.5%	30 mw.	50/500/5k $\Omega$	\$70	Tuning-fork
Hewlett-Packard	100-A	100/1000/ 10k/100k c.p.s.	3 c.p.s. per mc. per deg. C.	5 v.	1000 $\Omega$	\$450	Crystal osc.
	100-B	100/1000/ 10k/100k c.p.s.	$\pm 0.001\%$	5 v.	1000 $\Omega$	\$500	Crystal osc.
Furzehill	1100	10 kc/100 kc/ 1 mc.	$\pm 0.005\%$	—	—	—	Crystal osc.
	1744	1 kc/10 kc/ 100 kc/1 mc.	$\pm 0.005\%$	—	100 $\Omega$	—	Crystal osc.
Times Facsimile	FK-2	1800 c.p.s.	0.001%	0.5 v.	600 $\Omega$	\$275	Tuning fork
	FKP, FKC	1800 c.p.s.	0.001%	0.5 v.	600 $\Omega$	\$350	Tuning-fork
	FK-4	1800 c.p.s.	0.001%	10 v.	1 meg. $\Omega$	\$225	Tuning-fork
General Radio	572-B	1000 c.p.s.	$\pm 10\%$	—	10/300 $\Omega$	\$12.50	Tuned reed
Shallcross	691-A	1000 c.p.s.	—	—	600 $\Omega$	\$45	Vacuum-tube osc.

### MULTIMETERS CONTAINING AUDIO-FREQUENCY VACUUM-TUBE VOLTMETERS

Manufacturer	Model number	Quantities measured	Voltage range (full-scale)	Frequency range	Accuracy	Input impedance	Price
RCA (Volt-Ohmyst)	195-A	V-O	5-1000	30-100,000	—	200k. $\Omega$ , 170 $\mu$ fd.	\$79.50
Hewlett-Packard	410-A	V-O	1-300	20 c.p.s.-700 mc.	3%	10 meg., 1.3 $\mu$ fd.	\$245
Ferret	730(1)	V-O	1-3000	to 300 mc.	3%	10 meg.	\$99.95
Clippard	406	V-O	1-1000	30 c.p.s.-100 mc.	2%-5%	7 meg., 7 $\mu$ fd.	\$89.50
Jackson	645	V-O-ma.	1-1000	50-200,000	—	4.4 meg.	\$69.50
Philco	7001	V-O-ma.	1-100	50 c.p.s.-30 mc.	5%	15 meg. 2.7 meg., 5.5 $\mu$ fd.	\$104.50
Precision	EV-10	V-O-ma.	3-6000	AF-RF	—	—	\$104.35
Radio City Prod.	669	V-O-ma.	3-1000	AF & Supersonic	—	11 meg.	\$59.50
Reiner	456	V-O-ma.-C	3-6000	10 c.p.s.-500 mc.	—	25 $\mu$ fd., 2 $\mu$ fd.	\$210
	451	V-O-ma.	2.5-1000	AF-700 mc.	—	7 $\mu$ fd.	\$125
McMurdo Silver	900-A	V-O-ma.	3-1200	20 c.p.s.-100 mc.	5%	20 meg., 7 $\mu$ fd.	\$68.50
Supreme	574	V-O-ma.	1-2500	AF-100 mc.	—	10 meg., 9 $\mu$ fd.	\$72.50
Sylvania	221	V-O-ma.	3-1000	20 c.p.s.-500 mc.	—	2.7 meg., 40 $\mu$ fd. 194 $\mu$ fd.	\$99.50
Hickok	209-A	V-O-ma.-C	3-1200	to 200 mc.	—	12 meg., 6 $\mu$ fd.	\$199
	203	V-O-ma.-C	3-1200	to 200 mc.	—	12 meg., 6 $\mu$ fd.	\$149
Electronic Designs	100	V-O	3-50	60 c.p.s.-100 mc.	$\pm 3\%$	1 meg., 3 $\mu$ fd.	\$59.50
Simpson	266	V-O-ma.	1-5000	AF-RF	—	10 meg., 4 $\mu$ fd.	\$114
Electronic Instr. Co.	113-A(1)	V-O	5-1000	to 30,000	—	1.5 meg.	\$69.95
	210	V-O	5-1000	50 c.p.s.-200 mc.	2%	1.5 meg.	\$69.50
CONSTRUCTION KITS: Heath	V-2	V-O	3-1000	AF-RF	—	11 meg.	\$24.50
Electronic Instr. Co.	221	V-O	5-1000	—	2%	—	\$23.95

Notes: (1) Contains audio amplifier and loudspeaker for signal tracing. (2) V—volts (a.c.-d.c.); O—ohms; ma.—milliamperes and amperes; C—capacity

(Continued on page 106)



# FIXED BIAS FOR AUDIO OUTPUT STAGES

*An analysis of various circuits used to obtain fixed bias for triode or pentode output stages.*

By JOSEPH R. BOOKEE

**W**HEN an amplifier builder decides that it is time to create a masterpiece, he comes to the necessity for a decision between beam power and triodes. He must choose from available types a tube or set of tubes which will both deliver the amount of output power he needs and satisfy his requirements as to fidelity and economy. The controversy between the proponents of triode output stages and those favoring beam power tetrodes with large amounts of inverse feedback will not affect the point of discussion here one whit. The purpose of this article is to enumerate the engineering and performance characteristics of stages employing fixed bias and show the advantages offered by the use of fixed bias to either of the two types of audio amplifier design.

A good point to begin with, perhaps, is that more power output can be achieved with the same tubes, using fixed bias, than can be obtained using self bias. Furthermore, this will be at no cost of increased harmonic distortion, and the tubes will run at the same or lower zero-signal plate current ("plate dissipation"). This means that greater power efficiency will result. Here are some examples of the improvement, as shown for two popular tube types.

Type 6V6 beam power pentode. Operating conditions as a push-pull "Class AB<sub>1</sub>" power output stage are given in Table 1; all values are for two tubes.

It is well to remember certain facts about this fixed bias operation. Although the operating conditions given are nominally for fixed bias in "Class AB<sub>1</sub>," the facts that define the operation as "Class AB<sub>1</sub>" are that no appreciable grid current flows during any portion of a signal cycle and that plate current flows for more than half of the signal cycle. Since these tubes are being biased not far from cut-off, as far as plate current flow is concerned

the operation is more like "Class B" than "Class A." Although the harmonic distortion does not seem to increase, it is entirely possible for intermodulation effects to increase, especially if power supply regulation is not good enough. The customary inverse feedback will remedy this.

Types 2A3, 6A3, 6B4, and 6A5 are low mu triodes in widespread applications. Operating conditions for two tubes in push-pull "Class AB<sub>1</sub>" operation are shown in Table 2.

Because of the smaller plate load in fixed bias, the peak plate current is increased greatly. Also, because of the decreased plate load resistance, the power output would tend to be decreased slightly while the harmonic

distortion dropped sharply. Due to the increase (25%, or 62 volts) in effective plate-to-cathode voltage, the power output is increased by 50% anyway, while the greatly desirable 50% decrease in harmonic distortion remains.

Now we come to the argument having the most subtle persuasiveness of all. The tube operating under fixed bias will tend to have less transient distortion because of the elimination of a main source of incremental plate resistance. Since there is no cathode resistor, as such, there is no tendency toward inverse feedback of the type termed "current feedback," which tends to raise the plate resistance and, hence, the internal generator impedance of the amplifier circuit.

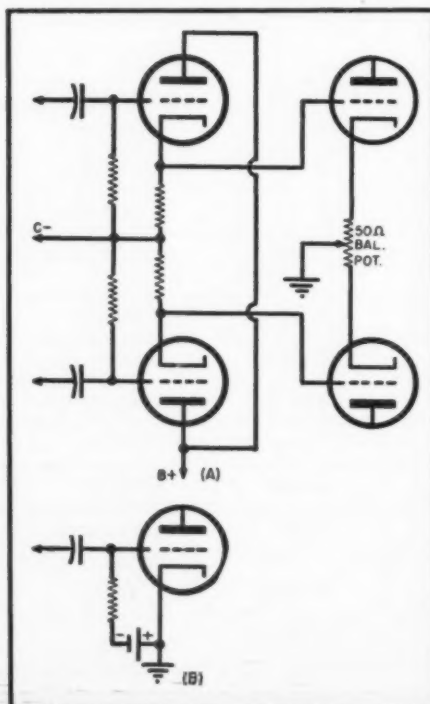
Transient and pulse behavior are dependent on the phase and amplitude response of the system at the extreme high and low ends of the frequency response spectrum, just as well as at the intermediate frequencies. A bypass condenser of any finite size, connected in parallel with any given cathode bias resistor, will introduce a phase shift which increases as frequency decreases. By choosing a large enough value of capacitance, this effect can be minimized for as low a frequency as is desired, say 20 or 30 cycles, or less. (It is necessary to bypass a common cathode resistor even in push-pull amplifiers, or all harmonics will be reintroduced to both grids in-phase; this will increase the total distortion very greatly.)

The designer of an amplifier incorporating more than about 20 db. of inverse feedback soon finds that he is going to total phase shift in the feedback loop at less than 180° at frequencies of one or two cycles or less, if he is to avoid low-frequency parasitic oscillations, to say nothing of the peak in amplitude and general instability of response which take place if the phase shift is not sufficiently less than the criterion of 180°. Thus, the point remains that the low-frequency phase shift causes pulse and transient instabilities of various orders when bypassed self-bias resistors are employed; that these types of distortions are extremely undesirable in high-quality audio equipment; and that by the use of fixed bias, these difficulties can be solved more economically and without the use of extraordinarily large condensers. How this is done will be shown shortly.

It cannot be denied that the use of fixed bias has its drawbacks. The first point to be considered is that some means must be provided to balance inequalities in plate current between the two sides of the push-pull amplifier. The reason for this is that modern output transformers, which have cores of very large permeability, are susceptible to core saturation if there is current unbalance in the split primary windings. If this unbalance is less than about 10%, the effect will be a loss of low-frequency response; if it is more, serious distortion will result.

Unbalance can be easily corrected

Fig. 1. (A) Schematic of a cathode follower driver stage. (B) Application of a bias cell.





by any one of several simple and inexpensive methods. A resistor of suitable value, or even better, a potentiometer used at the cathode of the overconducting tube, connecting it to ground, will remedy the situation. A very common way to adjust for this is to connect each leg of a small wire-wound pot to each cathode and ground the tap. This is excusable because a tube which has too low a d.c. current resistance will usually have, in addition, a low plate resistance. The small amounts of current feedback introduced by these cathode balancing resistors will tend to raise the offending tube's plate resistance and lower its transconductance until it is in balance with the other tube. This is desirable when full use of the distortion-cancelling effect of push-pull operation is wanted.

Another method is to provide separate bias-supply bleeders for each of the tubes, which may then be balanced empirically by adjusting the grid bias values separately. These adjustments are necessary at all times, even in self bias operation where one employs tubes of high transconductance, such as the 6A5G or 6AS7G. It is also well to remark that as tubes age, these adjustments must be corrected from time to time. This is the reason for the permanent plate current metering and screwdriver adjusting pots found in professional high-quality equipment.

Another point is that the maximum permissible value of input grid resistor is appreciably smaller under fixed bias than under self bias. In the case of the 6V6 and 6L6, 0.1 megohm may be used at most, as against .5 megohm in self bias. For members of the 2A3 family of triodes, .05 megohm is permissible, as against .5 megohm in self bias. The reason for this is that there seems to be a small amount of grid current that must be allowed to flow, because of the connection between grid current and the larger plate current excursions which take place under the fixed bias conditions. There may be less potential difference between the plate and the cathode than there is between the cathode and the grid, in which case one obtains a little more grid rectification than occurs in the self-bias condition where plate current excursions are not so great.

Since a given *RC* constant must be upheld in order to preserve a given bass response and phase shift characteristic, the conclusion is reached that some large values of coupling capacitance are needed if conventional *RC* coupling circuits are to be employed and extremely good response is desired. For example, a good combination to use in feedback loops is an .1  $\mu$ fd. condenser coupled to a grid resistor of .5 megohms resistance. To get the same quality of response when .05 megohms is the largest permissible grid resistance, one would have to use an 1  $\mu$ fd. coupling condenser. This is not too good, because the con-

	SELF BIAS	FIXED BIAS	
Plate voltage .....	250	250	v.d.c.
Screen voltage .....	250	250	v.d.c.
Plate current—			
Zero signal .....	70	40	ma.
Peak signal .....	79	79	ma.
Screen current .....			
Zero signal .....	5	3	ma.
Peak signal .....	13	13	ma.
Load resistance, c.t. ....	10,000	10,000	ohms
Grid bias .....	-15	-25	v.
Power output .....	10	16	watts
Total Harmonic distortion .....	5%	5%	

Operating conditions are for 2 tubes in push-pull "Class AB<sub>1</sub>."

Table 1. Operating conditions of the 6V6 as a push-pull "Class AB<sub>1</sub>" power output stage.

denser becomes rather bulky and therefore difficult to wire in. As a consequence it tends to have a rather high capacitance to ground and too high a leakage current with all the associated dangers. Any ordinary condenser will probably also have too high a power factor because the leakage resistance is too low. In high-impedance circuits, the power factor consideration is negligible, but the leakage current may upset the bias of the grid by making it a few volts more positive with respect to ground. This is not a desirable condition, even though it is easily compensated for, because the leakage resistance of the coupling condenser is likely to decrease further as the part ages in operation.

It is for these reasons that transformer and impedance coupling methods are advisable, especially when not too much, if any, inverse feedback is to be applied around this circuit element. The d.c. resistance of the wire windings of the coupling inductance from the grid terminal to ground is never more than a few thousand ohms and is much less than that if the part is of any quality. At the same time, of course, the impedance to the audio signal can be as large as desired, just so long as enough inductance is provided. This method, however, is expensive; the parts are bulky, and there is always some trouble with hum pickup. Furthermore, though frequency response can be made very good, it will be found that there is too much phase shift at the near extremes of the response band for any significant amount of inverse feedback to be employed. This can be compensated for by the use of complicated *RC* net-

works linking, say, the primary and secondary of an interstage transformer, and near ideal results are possible. One can see an example of this type of engineering in the schematic of a very well respected amplifier which features the use of a triode output stage.

The author believes that cathode followers do the job better. Fig. 1A shows a system for direct coupling push-pull cathode follower drivers to the grids of the output tubes. It must be remembered that the bias of the output tubes must be increased because of the zero signal *IR* drop in the cathode follower load resistors. One should also remember that the negative voltage swing of the signal delivered by a cathode follower is limited to the amount of bias under which the tube operates, although there is no limit to the positive swings but the available plate supply voltage. This is nothing to worry about. The combined signal of the two cathode followers will be distortionless; so if the output tubes are now put under heavy negative bias, they can still operate linearly for all input signals, peaks on the more negative (the more nonlinear) side of the operating point already being reduced by the cathode followers. A power tube operating heavily biased does not draw much zero-signal plate current at all. It is easy to see therefore that this system can give a pretty high order of efficiency while it sacrifices nothing to distortion.

The cathode followers have many desirable properties. The grid circuit of the output tubes will have very low impedance and resistance to ground. This will satisfy the requirement that

Table 2. Operating characteristics of the 2A3, 6A3, 6B4, and 6A5 low mu triodes.

	SELF BIAS	FIXED BIAS	
Plate voltage .....	300	300	v.d.c.
Plate current—			
Zero signal .....	80	80	ma.
Peak signal .....	100	147	ma.
Grid bias .....	-62	-62	v.
	(780 ohm resistor)		
Load resistance .....	5000	3000	ohms
Power output .....	10	15	watts
Harmonic distortion .....	5%	2.5%	

Operating conditions are for 2 tubes in push-pull "Class AB<sub>1</sub>."



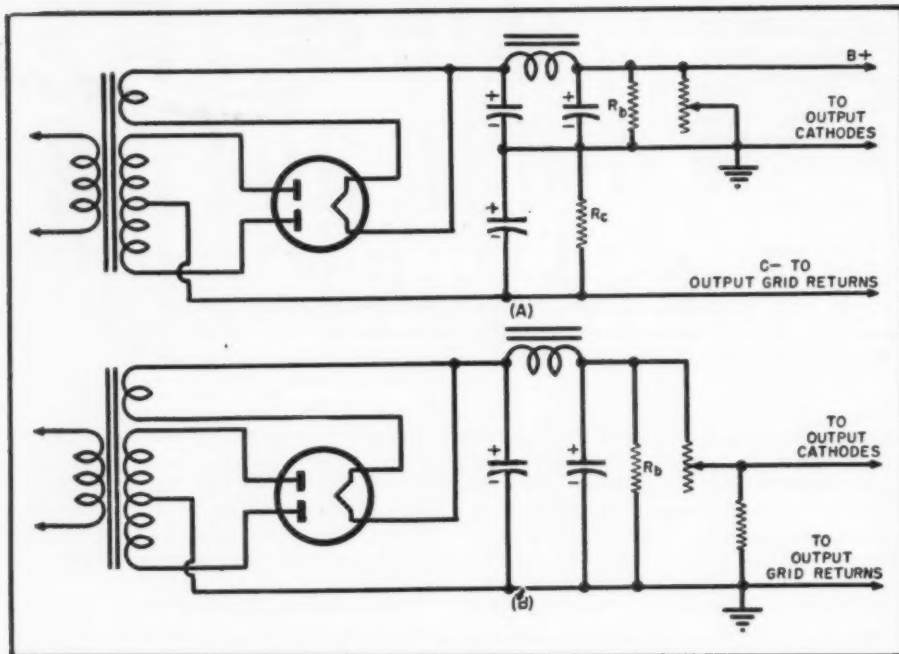


Fig. 2. How bias is obtained from main power supply: (A) Back bias and (B) self bias.

the grid leak be small. The low impedance to ground prevents high-frequency losses due to capacitance to ground leakage as does the coupling property of the cathode follower itself. The low impedance of the input circuit makes it quite possible to drive the output tubes very hard, without any of the usual positive peak flattening and clipping when the input signal approaches the value of the fixed bias and the grids approach within less than a volt of cathode potential. Not too much distortion will result if the grids are driven slightly above cathode potential, provided the drivers are capable of delivering power.

The cathode followers introduce no phase shift in themselves; there is not the customary  $180^\circ$  shift due to the presence of a tube stage, and due to the extremely high input impedance there will be far less high-frequency attenuation at the input to the cathode follower stages than there would

be at the input to any other type of grid-driven stage, such as the output stage.

The slight attenuation of signal voltage characteristic of cathode followers is very easily compensated for by providing a little more gain in the previous stages.

Now let us discuss some of the means for obtaining fixed bias. None of them offers the simplicity, economy, or compactness of the self-bias method, but this is no more than an engineering detail to the perfectionist. There are some ideas incorporated into the circuits given here which may prove helpful in other design problems.

The first, and most obvious, method is to use a battery. Fig. 1B shows the correct connection. This is the same circuit connection as was used with the specially-designed "C" batteries or "bias cells" in the days before the "all-electric" a.c. or a.c.-d.c. power

supply. Bias cells are still used in some high-gain microphone stages, where self or grid-leak bias will create hum problems. This system is rare nowadays in power output stages because the batteries do not last long enough in such service. They dry out, are bulky, expensive, and have too poor a regulation due to the high internal resistance necessary to good shelf life.

Figs. 2A and 2B show how bias is obtainable from the main power supply bleeder; Fig. 2A is sometimes termed "back bias." Fig. 2B shows the self-bias method by comparison. Back bias approaches self bias in operation as less and less current flows through the main bleeder and the constant-current portion of the power-supply load. If the bleeder current is of large enough magnitude, the voltage across the bias determining resistor becomes as nearly constant as desired. The bypass capacitance will help in further smoothing the bias voltage.

This method can be quite inexpensive to install, because the additional cost of a heavier power transformer and filter system and the heavier bleeders will not be as much as that of a completely separate bias supply. The main power supply will also benefit by improved regulation and dependability. The main defect of this system is that effective plate supply voltage is lost, just as in self bias. When one has to supply a good 60 volts bias, as with 2A3's, this is undesirable.

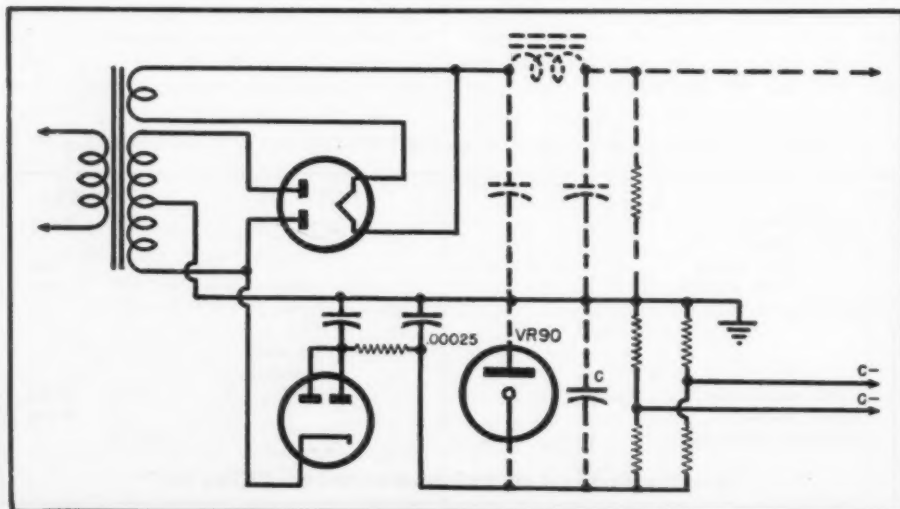
In Fig. 3 is shown a widespread and popular circuit known as the "side rectifier." It works by rectifying the negative phase of the supply cycle, instead of the positive phase, as in the usual positive supply. Although it would be desirable to employ a full-wave rectification circuit, this is not possible if one is to use any of the common cathode-type rectifiers, unless one wishes to employ two tubes. The type 6H6 or 6AL5 will not allow enough current to flow for good regulation, although the separate cathode pins for each diode section make the use of a full-wave circuit possible.

Some power transformers are supplied with a bias tap about 60 to 70 volts up from one side of the high voltage winding center tap. This sort of tap will usually deliver the right amount of bias for a pair of 2A3's from the proper rectifier and filter. Adjusting resistance values and tap bleeders to get any required smaller bias voltage is a simple matter indeed. This circuit requires a rectifier tube which will usually draw a fairly heavy filament current. Type 6X5, for example, will draw 0.6 amperes at 6.3 volts.

The circuit of Fig. 4A affords two advantages over previous ones. The first advantage is the elimination of a rectifier tube and the saving of its filament current. The midge selenium rectifier will run more coolly than the tube and will have better reg-

(Continued on page 120)

Fig. 3. Schematic diagram of a popular circuit usually referred to as the side rectifier.



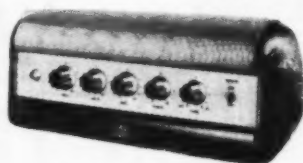


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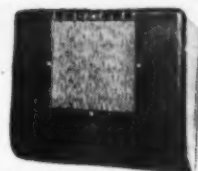
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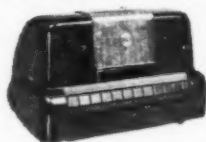
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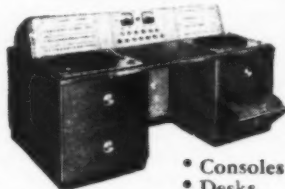
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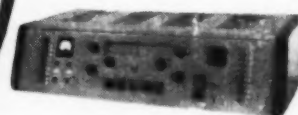
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Simultaneous broadcasts are made on frequencies 6997.5 kc., 14405 kc., and 20994 kc. Each message is sent three times, once at 10 words per minute, once at 15 words per minute, and once at 20 words per minute.

Designed especially to transmit quasi-official traffic and training information to MARS members, the broadcast offers an excellent opportunity to all amateurs in building up their code proficiency.

**T**HE once proud blacksmith shop at Fort McPherson, Georgia, is no more. The reverberating clang of hammer on red-hot iron and anvil has been replaced by the beat note, the intermittent whine of dots and dashes of a radio transmitter. For the little brick structure which once housed the Post blacksmith shop is now the home of A4USA, Military Amateur Radio System Headquarters Station for the Third Army Area.

The smithy has proved an ideal location for the amateur shack, according to Major Harold B. Lynn, director, Third Army MARS. It furnishes Army hams with a private meeting place and with station facilities for off-duty amateurs to pound brass and rag-chew.

Instruction rooms are available where a code school is conducted. Most of the students have had some previous experience in radio and code. The course includes preparation for the FCC examination for an amateur license.

Basic equipment in A4USA includes

a BC-610, a Super Pro, an SX-28, a Meissner Signal Shifter, and a VH-152. Equipment is also available for transmitting the weekly bulletins to all MARS members in the Third Army Area (both tape machine and electronic key are used). The BC-610 is used on all bands, 80 through 10, both c.w. and phone. Doublet antennas are used on 80, 40 and 20, but a rotary beam is up for 10 meter use.

A4USA was control station in the MARS-Army Standby Communications Net during the August hurricane which struck Florida and swept northward through the Third Army area. With 14th Air Force Headquarters at Orlando, Florida, A4USA monitored all frequencies used by the emergency nets of Florida and Georgia. Seventy-one member stations were alerted in the Third Army net. Reports direct from the storm area were intercepted and transmitted direct to WAR, MARS-Army Headquarters Station in Washington, D. C. Emergency traffic, including storm reports, were broad-

Maj.-Gen. William C. Chase, Third Army Chief of Staff, calls CQ at the W4USA-A4USA mike, with Capt. James A. Long, first MARS director of the Third Army area, standing by.





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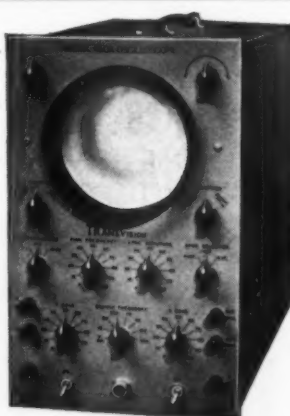
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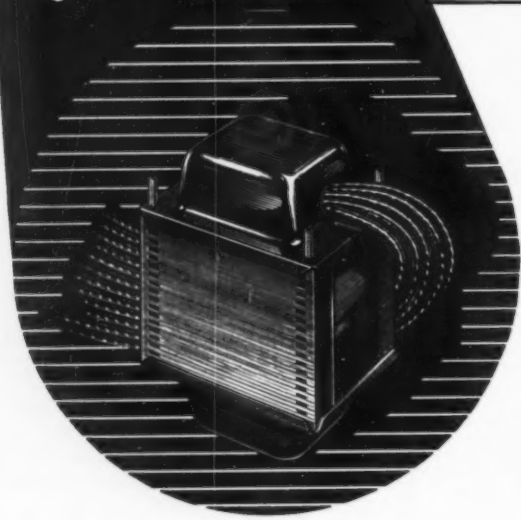
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**Deflection Yoke.** Stancor Part Number DY-1. Exact duplicate of RCA type 201D1. For use with direct viewing kinescopes such as 7DP4 and 10BP4.

**Focus Coil.** Stancor Part Number FC-10. Exact Duplicate of RCA type 202D1. For use with magnetically focused kinescopes such as RCA type 10BP4.

**Horizontal Deflection Output and HV Transformer.** Stancor Part Number A-8117. Exact duplicate of RCA type 211T1. For use with direct viewing kinescopes, such as types 7DP4 and 10BP4.

For complete specifications and prices of these and other Stancor TV replacement components, see your Stancor distributor or write for Television Catalog 337.

**NEW**—Ask your Stancor distributor for your copy of the latest edition of Stancor's TV Components Replacement Guide, Bulletin 338B. Lists Stancor replacement parts for 108 TV receivers made by 37 manufacturers. Or write us today.



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## 30-44 Megacycles FM

### PR-30 Receiver For MOBILE CALLS

Emergency thrills . . . hear "news in the making" . . . as it happens.

6 Tube superheterodyne, 115 volts, AC or DC. Now you may enjoy . . .  
• POLICE • MARITIME  
• FIRE • FORESTRY  
• HIGHWAY TELEPHONE

**\$44.95**  
LIST PRICE

PR-7 POLICALARM tunes 152-162 mc. \$39.95  
See your dealer or write Dept. RN-2



**POLIC FM ALARM**

RADIO APPARATUS CORP.  
303 FOUNTAIN SQ. THEATER BLDG.  
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cast until the hurricane emergency was declared terminated.

No damage was sustained by A4USA as a direct result of the hurricane. However, many MARS members in the central and lower Florida report their antennas were literally "gone with the wind" as cyclones up to 150 miles an hour struck their homes.

—30—

## CANADIAN MICROWAVE RELAYS FOR TV

**SIMILAR** to relays for television that have been installed in the United States, Philco microwave equipment was used to present television programs to 2,000,000 visitors who attended the Canadian National Exhibit in Toronto recently. This is believed to be the first use of such relays in Canada.

Particularly timely since the Canadian Broadcasting Company is just developing television broadcast networks in the Dominion, the telecasts included television shows from WBEN-TV (Channel 4) from Buffalo, N. Y., and still pictures and recordings from the experimental station VE9KE at the Philco factory in Toronto to the site of the fair.

Signals from the Buffalo television station were picked up by a special high-gain antenna, fed to the input of the relay transmitter, beamed by microwave to the relay receiver at the fairgrounds, and then displayed on typical home television sets.

—30—

### TV SET SHIPMENTS BY AREAS

TELEVISION SERVICES AREA	HALF-YEAR (1949)	ACCUMULATIVE (SINCE 1-1-47)
Albany, N. Y.	9,801	22,580
Albuquerque, N. M.	71	317
Atlanta, Ga.	3,184	8,015
Baltimore, Md.	21,158	49,259
Birmingham, Ala.	2,199	2,222
Boston, Mass.	49,286	88,233
Buffalo, N. Y.	12,092	21,196
Charlotte, N. C.	1,718	1,949
Chicago, Ill.	77,278	156,694
Cincinnati, O.	19,196	33,283
Cleveland, O.	31,406	52,714
Dallas, Texas	2,016	8,303
Davenport, Iowa	473	921
Detroit, Mich.	36,535	62,871
Erie, Pa.	690	993
Greensboro, N. C.	562	562
Houston, Texas	2,106	4,365
Huntington, W. Va.	30	30
Indianapolis, Ind.	5,704	6,276
Jacksonville, Fla.	95	95
Kansas City, Mo.	4,549	5,098
Los Angeles, Calif.	60,407	137,332
Louisville, Ky.	2,042	5,161
Memphis, Tenn.	1,970	5,072
Miami, Fla.	2,800	3,643
Milwaukee, Wisc.	10,439	23,378
Minneapolis, Minn.	4,711	10,947
Nashville, Tenn.	50	113
Newark, N. J.	59,978	163,504
New Haven, Conn.	10,733	27,805
New Orleans, La.	1,691	5,674
New York City	152,619	425,648
Oklahoma City, Okla.	2,810	2,838
Omaha, Nebr.	1,109	1,146
Philadelphia, Pa.	75,222	204,461
Phoenix, Ariz.	22	22
Pittsburgh, Pa.	15,185	21,323
Portland, Ore.	425	559
Richmond, Va.	2,879	6,100
St. Louis, Mo.	12,944	29,196
St. Petersburg, Fla.	51	95
Salt Lake City, Utah	861	1,862
San Antonio, Texas	87	87
San Francisco, Calif.	7,897	20,194
Seattle, Wash.	2,591	7,160
Syracuse, N. Y.	2,196	4,599
Toledo, O.	7,378	13,008
Tulsa, Okla.	203	203
Washington, D. C.	22,709	53,305
Miscellaneous	—	5,961
<b>TOTAL</b>	<b>742,166</b>	<b>1,706,372</b>

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RADIO & TELEVISION NEWS





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## CREI Can Help You EARN MORE MONEY

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**L**ATEST FIGURES show over 2,200,000 TV receivers now in use in the U. S. Twelve million sets are predicted by 1953, and practically every area of the nation will be within range of a TV station! Servicemen will have greater and greater opportunities, and those servicemen with specialized Television and FM training will have greater and greater opportunities, and those of AM only—both in competing for jobs and in trying to make a go of their own repair businesses.

CREI knows what you need. This specialized servicing course is the practical answer to the technical problems that bother the average serviceman when he faces the job of servicing today's intricate TV and FM equipment. Every lesson in this course is practical and helpful in your daily work. Lessons are revised as new developments become accepted by the industry.

Start your training now and you start applying your new-found knowledge immediately. You will be in demand and can be earning more money as you find yourself handling TV and FM work that only a few months ago looked "impossible."

This can be your big chance! Write today for complete facts. (Veterans: CREI training is available under the G.I. Bill. For most veterans, July 25, 1951 is the deadline—act now.)

**SAMPLE LESSON FREE!** "Television and FM Trouble Shooting"—this lesson is devoted to live, "dollar-and-cents", practical practice based on day-to-day servicing problems. Read this interesting lesson and see for yourself how CREI training can help you. Mail coupon for this sample lesson, free booklet and details.

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  - ☐ PRACTICAL RADIO ENGINEERING
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  - ☐ BROADCAST RADIO ENGINEERING (AM, FM, TV)
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# NEW 1950

# Heathkits

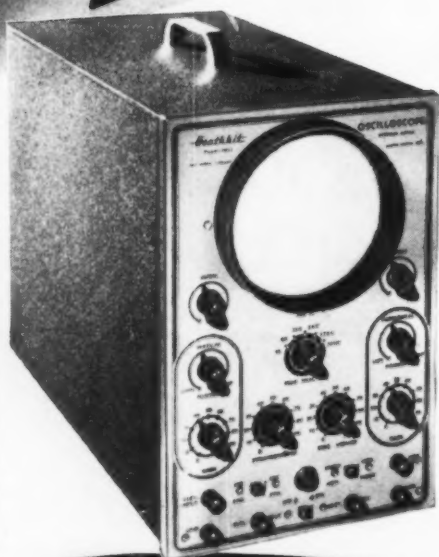
have all the Features

New 1950 Heathkit

## PUSH-PULL EXTENDED RANGE 5" OSCILLOSCOPE KIT

### Features

- The first truly television oscilloscope.
- Tremendous sensitivity .06 Volt RMS per inch deflection.
- Push-pull vertical and horizontal amplifiers.
- Useful frequency range to 2½ Megacycles.
- Extended sweep range 15 cycles to 70,000 cycles.
- New television type multivibrator sweep generator.
- New magnetic alloy shield included.
- Still the amazing price of \$39.50.



**\$39.50**

The new 1950 Push-Pull 5" Oscilloscope has features that seem impossible in a \$39.50 oscilloscope. Think of it—push-pull vertical and horizontal amplifiers with tremendous sensitivity only six one hundredths of a volt required for full inch of deflection. The weak impulses of television can be boosted to full size on the five inch screen. Traces you couldn't see before. Amazing frequency range clear useful response at 2½ Megacycles made possible by improved push-pull amplifiers. Only Heathkit Oscilloscopes have the frequency range required for television. New type multi-vibrator sweep generator with more than twice the frequency range. 15 cycles to 70,000 cycles will actually synchronize with 250,000 cycle signal. Dual positioning controls will move trace over any section of the screen for observation of any part. New magnetic alloy CR tube shield protects the instrument from outside fields. All the same high quality parts, cased electrostatically shielded power transformer, aluminum cabinet, all tubes and parts. New instruction manual now has complete step by step pictorials for easiest assembly. Shipping Weight 30 lbs. Order now for this winter's use.

#### CONVERSION FOR OTHER MODEL HEATHKIT OSCILLOSCOPES

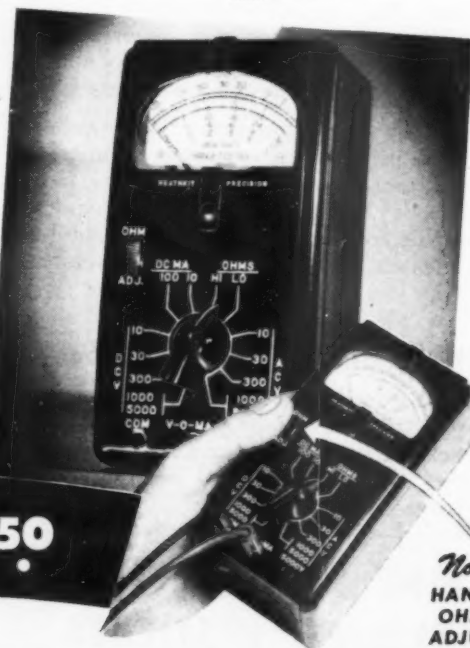
A conversion for all 03 and 04 scopes is available changing them to the new push-pull amplifiers (does not change the sweep generator). Complete kit includes new chassis, tubes and all parts. For a small investment, add the latest improvements to your present oscilloscope (Except C.R. Tube Shield). Shipping weight 10 lbs. Order 05 Conversion Kit No. 315. **\$12.50**

## THE NEW Heathkit HANDITESTER KIT

MORE Features THAN EVER BEFORE

- Beautiful streamline Bakelite case.
- AC and DC ranges to 5,000 Volts.
- 1% Precision ceramic resistors.
- Convenient thumb type adjust control.
- 400 Microampere meter movement.
- Quality Bradley AC rectifier.
- Multiplying type ohms ranges.
- All the convenient ranges 10-30-300-1,000-5,000 Volts.
- Large quality 3" built-in meter.

The instrument for all—the ranges you need—beauty you'll enjoy for years and you can assemble it in a matter of minutes—an instrument for everyone. The handiest quality voltmeter of all. Small enough to put in your pocket yet a full 3" meter. Easy pictorial wiring diagrams eliminate all assembly problems. Uses only 1% precision ceramic divider resistors and wire wound shunts. Twelve different ranges. AC and DC ranges of 10-30-300-1,000-5,000 Volts. Ohms ranges of 0-3,000 ohms and 0-300,000 ohms. Milliampere ranges of 10MA and 100MA. Hearing aid type ohms adjust control fits conveniently under thumb for one hand adjustment. Banana type jacks for positive low resistance connections. Quality test leads included. The high quality Bradley instrument rectifier was especially chosen for linear scales on AC. The modern case was styled by Harrah Engineering for this instrument. The 400 microampere meter movement comes already mounted in the case protected from dust during assembly. An ideal classroom assembly instrument useful for a lifetime. Perfect for radio service calls, electricians, garage mechanics, students, amateurs and beginners in radio. The only quality voltmeter under \$20.00. An hour of assembly saves you one-half the cost and quality parts give you a better instrument. Order today. Shipping weight 2 lbs.



**\$13.50**

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# MORE QUALITY in

*1950 Heathkits*

## The NEW 1950 Heathkit VACUUM TUBE VOLTMETER KIT

### Features

- New 200 microampere meter.
- Uses 1% precision ceramic divider resistors.
- Burn-out proof meter circuit.
- 24 complete ranges.
- Isolated probe for dynamic testing.
- Most beautiful VTVM in America.
- Accessory probes (extra) extend ranges to 10,000 Volts and 100 Megacycles.
- Modern push-pull electronic voltmeter circuit.
- Electronic AC circuit. No current drawing rectifiers.
- Shatterproof plastic meter face.



**\$24.50**

A new Model V-2 Heathkit VTVM with new 200 microampere meter four additional ranges—full scale linear ranges on both AC and DC of 0-3 V., 10 V., 30 V., 100 V., 300 V., and 1,000 V. Accessory probe listed elsewhere in ad extends voltage range to 3,000 and 10,000 volts D.C. New model has greater sensitivity, stability and accuracy—still the highest quality features—shatterproof plastic full view meter face—automatic meter protection, push-pull electronic voltmeter circuit, linear scales—db. scale—ohmmeter measures 1/10 ohm to 1 billion ohms with internal battery—isolated DC test prod for dynamic measurements—11 megohm input resistance on DC—AC uses electronic rectification with 6H6 tube. All these features and the amazing price of only \$24.50. Comes complete with cabinet—panel—three tubes—new Mallory switches—test prods and leads, 1% ceramic divider resistors and all other parts. Complete instruction manual for assembly and use. Better start your laboratory with this precision instrument. Shipping weight 8 lbs. Model V-2 .....

## New 1950 VERNIER TUNING R.F. Heathkit SIGNAL GENERATOR KIT

### Features

- New 5 to 1 ratio vernier tuning for ease and accuracy.
- New external modulation switch—use it for fidelity testing.
- New precision coils for greater output.
- Cathode follower output for greatest stability.
- 400 cycle audio available for audio testing.
- Most modern type R.F. oscillator.
- Covers 150Kc. to 34Mc. on fundamentals and calibrated strong harmonics to 102 Mc.



**\$19.50**

The most popular signal generator kit has been vastly improved—the experience of thousands combined to give you the best. Check the features in this fine generator and consider the low price \$19.50. A best buy for any shop, yet inexpensive enough for hobbyists. Everyone can have an accurate controlled source of R.F. signal voltage.

The new features double the value—think of being able to make fidelity checks on receivers by inserting a variable audio signal. Internal 400 cycle saw-tooth audio oscillator modulates R.F. signal and is available externally for audio testing. The new 5 to 1 ratio vernier drive gives hairline tuning for maximum accuracy in scale settings. The coils are already precision wound and calibrated. Uses turret type coil and switch assembly for ease of construction. The generator is 110 V. 60 cycle transformer operated and comes complete in every detail—cabinet—tubes—coils—beautiful two color calibrated panel and all small parts—new step-by-step pictorial diagrams and complete instruction manual make assembly a cinch even for novices. Why try to get along without a signal generator when you can have the best for less than a twenty dollar bill. Better order it now. Shipping weight 7 lbs. .... **\$19.50**

#### CONVERSION KIT FOR G-1 GENERATORS

Conversion kit for G-1 generators for vernier tuning and external modulation includes new high band coil for greater output. Gives all the features of new G-5 listed above. Order G-5 Conversion Kit No. 316. .... **\$4.50**

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## *New Heathkit* **IMPEDANCE BRIDGE KIT**

**A LABORATORY INSTRUMENT NOW WITHIN  
THE PRICE RANGE OF ALL**

Measures Inductance from 10 microhenries to 100 henries capacitance from .00001 MFD to 1000 MFD. Resistance from .01 ohms to 10 megohms. Dissipation factor from .001 to 1. "Q" from 1 to 1000.

Ideal for schools, laboratories, service shops, serious experimenters.

An impedance bridge for everyone — the most useful instrument of all, which heretofore has been out of the price range of serious experimenters and service shops. Now at the lowest price possible. All highest quality parts. General Radio main calibrated control. General Radio 1000 cycle hummer. Mallory ceramic switches with 60 degree indexing — 200 micro-amp zero center galvanometer — 1/2 of 1% ceramic non-inductive decade resistors. Professional type binding posts with standard 3/4" centers. Beautiful birch cabinet. Directly calibrated "Q" and dissipation factor scales. Ready calibrated capacity and inductance standards of Silver Mica, accurate to 1/2 of 1% and with dissipation factors of less than 30 parts in one million. Provisions on panel for external generator and detector. Measure all your unknowns the way laboratories do — with a bridge for accuracy and speed.

Internal 6 volt battery for resistance and hummer operation. Circuit utilizes Wheatstone, Hay and Maxwell circuits for different measurements. Supplied complete with every quality part — all calibrations completed and instruction manual for assembly and use. Deliveries are limited. Shipping weight, approximately 15 lbs.



### **10,000V. H.V. TEST PROBE KIT**

No. 310. Extends range of any 11 megohm VTVM to 3,000 and 10,000 Volt ranges. A necessity for television. Shipping Wt., 1 pound. **\$4.50**

### **R.F. CRYSTAL TEST PROBE KIT**

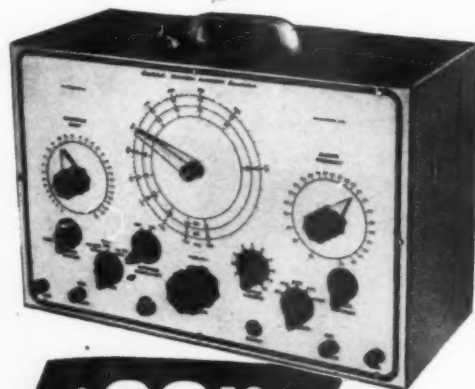
No. 309 Kit to assemble. R.F. probe extends VTVM range to 100 Mc. Complete with 1N34 crystal. Ship. Wt., 1 lb. ... **\$6.50**



### *New Heathkit* **TOOL KIT**

Now a complete tool kit to assemble your Heathkit. Consists of Krauter diagonal cutters and pointed nose assembly pliers, Xcelite screwdriver, 60 Watt 110V. soldering iron and supply of solder. Shipping Wt., 2 lbs. Complete kit ..... **\$5.95**

## *New Heathkit* **TELEVISION ALIGNMENT GENERATOR KIT**



**\$39<sup>50</sup>**

*Nothing* **ELSE TO BUY**

Everything you want in a television alignment generator. A wide band sweep generator covering all FM and TV frequencies 0-110 and 165 to 220 Megacycles, a marker indicator covering 19 to 43 Megacycles, AM modulation for RF alignment — variable calibrated sweep width 0-30 Mc. — mechanical driven inductive sweep. Husky 110V 60 cycle power transformer operated — step type output attenuator with 10,000 to 1 range — high output on all ranges — band switching for each range — vernier driven main calibrated dial with over 45 inches of calibration — vernier driven calibrated indicator marker tuning. Large grey crackle cabinet 16 1/8" x 10 3/8" x 7-3/16". Phase control for single trace adjustment. Uses four high frequency triodes plus 5Y3 rectifier — split stator tuning condensers for greater efficiency and accuracy at high frequencies — this Heathkit is complete and adequate for every alignment need and is supplied with every part — cabinet — calibrated panel — all coils and condensers wound, calibrated and adjusted. Tubes, transformer, test leads — every part with instruction manual for assembly and use. Actually three instruments in one — TV sweep generator — TV AM generator and TV marker indicator. Also covers FM band.

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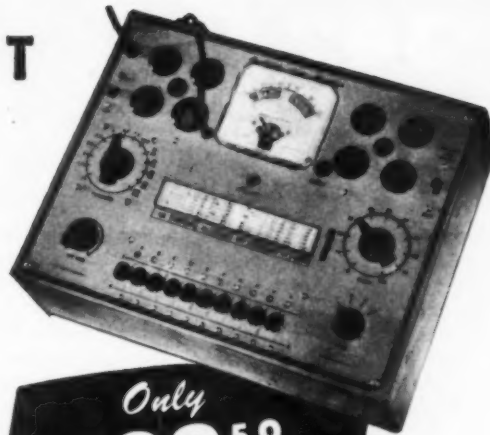
# all in HEATHKITS...

## Heathkit TUBE CHECKER KIT Features

1. Measures each element individually
2. Has gear driven roller chart
3. Has lever switching for speed
4. Complete range of filament voltages
5. Checks every tube element
6. Uses latest type lever switches
7. Uses beautiful shatterproof full view meter
8. Large size 11" x 14" x 4" complete
9. Checks new 9 pin piniaures

Check the features and you will realize that this Heathkit has all the features you want. Speed—simplicity—beauty—protection against obsolescence. The most modern type of tester—measures each element—beautiful Bad-Good scale, high quality meter—the best of parts—rugged oversize 110V. 60 cycle power transformer—finest of Mallory switches—Centralab controls—quality wood cabinet—complete set of sockets for all type tubes including blank spare for future types—fast action gear driven roller chart uses brass gears to quickly locate and set up any type tube. Simplified switching cuts necessary time to minimum and saves valuable service time. Short and open element check. No matter what arrangement of tube elements, the Heathkit flexible switching arrangement easily handles it. Order your Heathkit Tube Checker today. See for yourself that Heath again saves you  $\frac{2}{3}$  and yet retains all the quality—this tube checker will pay for itself in a few weeks—better build it now.

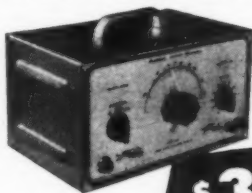
Complete with detail instructions—all parts—cabinet—roller chart—ready to wire up and operate. Shipping Wt., 15 lbs.



Only  
**\$29<sup>50</sup>**

Nothing  
ELSE TO BUY

### Heathkit SINE AND SQUARE WAVE AUDIO GENERATOR KIT



Nothing  
ELSE TO  
BUY

**\$34<sup>50</sup>**

Experimenters and servicemen working with a square wave for the first time invariably wonder why it was not introduced before. The characteristics of an amplifier can be determined in seconds compared to several hours of tedious plotting using older methods. Stage by stage, amplifier testing is as easy as signal tracing. The low distortion (less than 1%) and linear output ( $\pm$  one db.) make this Heathkit equal or superior to factory built equipment selling for three or four times its price. The circuit is the popular RC tuning circuit using a four gang variable condenser. Three ranges 20-200, 200-2,000, 2,000-20,000 cycles are provided by selector switch. Either sine or square waves instantly available at slide switch. All components are of highest quality, cased 110V. 60 cycle power transformer. Mallory F.P. filter condensers, 5 tubes, calibrated 2 color panel, grey crackle aluminum cabinet. The detailed instructions make assembly an interesting and instructive few hours. Shipping Wt., 13 lbs.

### New Heathkit BATTERY ELIMINATOR KIT

Nothing  
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TO BUY

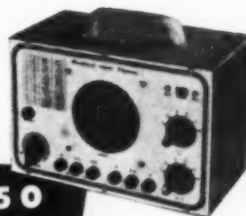


**\$22<sup>50</sup>**

Now a bench 6 Volt power supply kit for all auto radio testing. Supplies 5 - 7½ Volts at 10 Amperes continuous or 15 Amperes intermittent. A well filtered rugged power supply uses heavy duty selenium rectifier, choke input filter with 4,000 MFD of electrolytic filter. 0 - 15 Volt meter indicates output. Output variable in eight steps. Excellent for demonstrating auto radios. Ideal for servicing—can be lowered to find sticky vibrators or stepped up to equivalent of generator overload—easily constructed in less than two hours. Complete in every respect. Shipping Wt., 18 lbs.

### NEW Heathkit SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

Nothing  
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TO BUY



**\$19<sup>50</sup>**

The popular Heathkit signal tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker—locates intermittents—defective parts quicker—saves valuable service time—gives greater income per service hour. Works equally well on broadcast—FM or TV receivers. The test speaker has assortment of switching ranges to match push pull or single output impedance. Also test microphones, pickups—PA systems—comes complete—cabinet—110V. 60 cycle power transformer—tubes, test probe, all parts and detailed instructions for assembly and use. Shipping Wt., 8 lbs.

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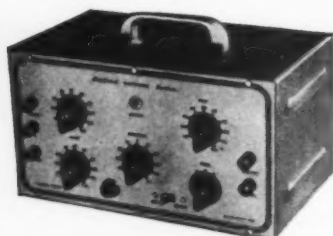
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**Enjoy them  
for years...**

**DOUBLES THE UTILITY OF ANY SCOPE**

*Nothing*  
ELSE TO BUY



## Heathkit 3-TUBE ALL WAVE RADIO KIT



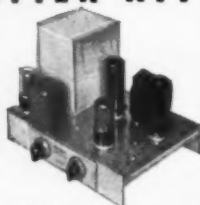
**\$875**

### CABINET EXTRA

HS30 Headphones per set.....	\$1.00
2 1/2" Permanent Magnet Loudspeaker.....	1.95
Maogany Cabinet.....	2.95

## Heathkit HIGH FIDELITY AMPLIFIER KIT

*Nothing*  
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BUY

**\$14.95**

12" PM Speakers for above...\$6.95  
Mahogany Speaker Cabinet,  
14 1/2" x 14 1/2" x 8".....\$8.75

**CABINET  
EXTRA**

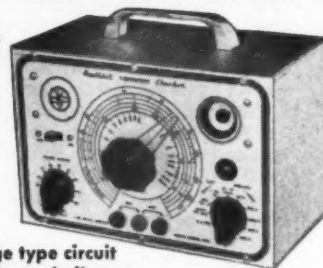
**\$147.5**

Beautiful mahogany cabinet for FM  
Tuner (shown above) extra.....\$3.75

## Heathkit

### CONDENSER CHECKER KIT

**\$19<sup>50</sup>**



## Features

- Power factor scale
- Measures resistance
- Measures leakage
- Checks paper-mica-electrolytics
- Bridge type circuit
- Magic eye indicator
- 110 V. transformer operated
- All scales on panel

Checks all types of condensers, paper-mica-electrolytic-ceramic over a range of .00001 MFD to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage for 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill. Shipping Wt., 7 lbs.

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[illegible]ENCLOSED FIND ☐ CHECK . . . ☐ MONEY ORDER FOR \_\_\_\_\_

PLEASE SHIP C.O.D. . . . POSTAGE ENCLOSED FOR \_\_\_\_\_ POUNDS

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# ELECTRONIC BARGAINS for EXPERIMENTERS and HOBBYISTS

ORDER NOW . . . ALL QUANTITIES LIMITED

**PE101C BC645 POWER SUPPLY**  
NO. 273. Complete power supply for BC 645. Operates from 12 or 24 Volts. Supplies both AC and DC required. Shipping Wgt. 13 lbs. Each **\$3.95**

**DM 35 12 VOLT DYNAMOTOR**  
NO. 274. New input 12 Volt at 18.7 Amperes. Supplies 675V at 275 MA or 1/2 above voltage from 6 volts. Excellent for auto use. Shipping Wgt. 11 lbs. Each **\$7.50**

## HOME WORKSHOP GRINDER KIT

NO. 230. Easily assembled 110V AC or DC ball bearing fully enclosed motor from Army surplus dynamotor. Purchaser to make simple changes and shaft extensions, detailed instructions and all parts supplied. Motor approximately 5,000 R.P.M. Ideal for tool-post grinder, flexible shaft tool, model drill press, saw. Shipping Weight 6 lbs. **\$3.95**

## COLLINS AUTOTUNE CONTROL HEAD

NO. 278. Brand new controls used on the ART/13, 100 Watt, Transmitter. Types 7, 8, 10, and 11 available. Get a spare while available as new cost is over \$22.00 each. Shipping Wgt. 3 lbs. Price any type (mention when ordering). Each **\$4.50**

**300 MA SELENIUM RECTIFIERS**  
NO. 209. Rated 300 MA at 36 Volts, complete with mounting brackets. Shipping Wgt. 1 lb. **3 FOR \$1.00**

## 1N90 FEED THROUGH INSULATOR

NO. 276. Heavy duty feed through, 2" diameter 4" long, complete with brass hardware and gasket. Shipping Wgt. 2 lbs. **2 FOR \$1.00**

## 1N86 STRAIN INSULATOR

NO. 277. Husky army type 1 1/4" diameter, 5 1/4" long. Brown porcelain. Shipping Wgt. 4 lbs. **4 FOR \$1.00**

## G.E. BC 306 ANTENNA TUNING UNIT

NO. 231. Matches any aerial to 150 Watt transmitter, used on BC 375. Brand new. Add postage for 20 lbs. **\$2.95**

## G. E. 1,000 VOLT 350 MA DYNAMOTOR

NO. 213. An ideal dynamotor for mobile operation in taxicabs, police cars, sound systems and amateur stations. Supplies above voltage from 12 Volts or 500V. at 350 MA from 6 Volts. Complete with starting relay, and fuses. New. Our Dynamotor A. Shipping Weight 72 lbs. **\$5.95**

## POWER TRANSFORMER Specials

NO. 226. Primary 117V. 60 cycle. Secondaries supply 746 V.CT at 220 MA, 6.3V. at 4.5 A., and 5V. at 4A. Will handle 13 tube radio receivers. Supply is limited, order early. Shipping Weight 11 lbs. each. **\$3.95 . . . 3 for \$9.95**

## T32 TABLE MICROPHONE

NO. 210. One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons. Add postage for 5 lbs. **\$2.95**

## MINIATURE ELECTRIC MOTOR

NO. 211. Tiny Delco motor only 1" x 1 1/4" x 2" 10,000 RPM. Operates from 6 to 24 V. Excellent for models. Add postage for 1 lb. **\$2.95**

## OUTPUT TRANSFORMER

NO. 227. Push pull 6V6's to 6-8 ohm voice coil excellent characteristics. **3 for \$1.95**

## RCA SATURABLE REACTOR TRANSFORMER

NO. 246. New RCA No. CKV30531 AC current 750 MA DC current 2 Amperes. Rated 1.75 henries. Shipping wgt. 4 lbs. Each **\$1.00**

## 12.6V POWER TRANSFORMER

NO. 247. New cased 110 V 60 cy. Power Transformer. Supplies 440V Ct. at 60 MA, 6.3V at 2A. and 12.6V at 1 Amp. Excellent for military sets. Shipping Wgt. 6 lbs. Each. **\$1.95**

## RCA INPUT TRANSFORMER

NO. 248. Heavy duty RCA No CKV-30529. Input has primaries 600 to 200 and 25 ohms secondary 250,000 ohms C.T. Shipping Wgt. 2 lbs. Each **\$1.00**

## FEDERAL POWER TRANSFORMER

NO. 252. New cased 110V 60 cy. Power Transformer. Supplies 480V CT at 50 MA and 6.3 V at 2.1 Amps. A beautiful transformer. Shipping Wgt. 4 lbs. Each **\$1.50**

## MILITARY POWER TRANSFORMERS

NO. 229. Convert your military receivers without rewiring the filament. "A" type supplies 500 VCT at 50 MA, 5V. at 2A. and 24V. at 1/2 A. "B" type supplies 500 VCT at 50 MA, 5V. at 2A. and 12V. at 1 Amp. State whether A or B type desired. Shipping Weight 4 lbs. **\$2.95**

## WALKIE TALKIE TRANSFORMER

No. 744. Carbon microphone input transformer and output to telephone transformer, all in one case, excellent for building your own. Shipping Wt. 1 lb. **4 for \$1.00**

## LOW PASS FILTER UNIT

No. 637. 3000 cycle cutoff consists of 3 inductances and 4 capacitors in network, 500 ohms in and out. Excellent for clipping all frequencies above 3000 cycles. Drawn steel case, shipping Wt. 5 lbs. **\$2.50**

## FM PUSH BUTTON TUNER

NO. 224. Brand new ten push button tuning assembly from Army FM receiver. Contains 4 gang 100 MMF silver plated tuning condenser. Add postage for 10 lbs. **\$2.50 EACH**

## BC 746 TUNING UNIT

NO. 257. Plug in transmitter tuning unit from army Walkie Talkie. Contains antenna and tank coils, tuning condenser, transmitting and receiving crystals. Ideal transmitter foundation. Shipping Wgt. 1 lb. Each **\$1.00**  
(Same as above except transmitter crystal in 80 meter amateur band **\$2.50 each**)

## T30 THROAT MICROPHONE

NO. 258. Makes excellent contact microphone for musical instrument or vibration pick-up. Shipping Wgt. 1 lb. **\$1.00 each**  
Extension cord with switch for above **\$.50 each**

## BC731 CONTROL BOX

with Weston Model 476 AC Voltmeter  
NO. 208. Excellent buy in motor control box. Size 8"x10"x5 1/2". Contains Weston 0-150V. AC 3 1/2" voltmeter, motor starting switch, 28 fuses all 30 Amp 110V. and 8 fuse holders. Fuses and holders alone worth the price. Shipping Weight 18 lbs. **\$7.95**

## METER SPECIAL

NO. 237. Brand new DeJur Model 312 0-800 M.A. D.C. Square 3" 0-10 M.A. basic meter with built in shunt. Probably the best buy ever offered in a surplus meter. Shipping Weight 1 lb. **\$2.95**

## HEARING AID HEADPHONES

NO. 216. The Army's best — eliminate flat ears and outside noise. Complete with transformer for conversion from low to high impedance. With cord and plug complete. Add postage for 1 lb. **\$1.00**

## BC 451 CONTROL BOX

NO. 236. Control box for 274N transmitters. Contains proper voice switch, 4 channel switch, power switch, mike jack and telegraph key. Add postage for 2 lbs. **\$1.95**

## 100 MA FILTER CHOKE

No. 641. Heavy 1.5 henry choke in drawn steel case, 50 ohm resistance, conservatively rated at 100 MA. Shipping Wt. 1 lb. **50c**

## FILAMENT TRANSFORMER

No. 922. 220V. 60 cy. primary supplies 12.6V. at 3.5 Amps, 15.6V at 1 Amp. Supplies 6.3 at 3.5 Amps and 7.8V. at 1 Amp from 110V. Shipping Wt. 8 lbs. **\$1.50**

## PANEL METER

Burlington O-300 VAC Meter  
No. 290. Model 32XA 3 1/2" round AC Voltmeter 0-300 VAC full scale. Scale also calibrated 0-600V. Bakelite case. A beautiful meter in original carton. Shipping Wt. **\$3.95**

## DRIVER TRANSFORMER

No. 651. Couples 3000 ohm plate to push pull parallel grids hermetically sealed. Ship. Wt. 1 lb. **\$1.00**

## OUTPUT and MODULATION TRANSFORMER

No. 745. Companion transformer to above driver. A push pull output, 3000 ohms to 3.2 ohm voice coil, or to 1250 ohms at 80 MA. A high quality cased unit. Shipping Wt. 2 pounds. **\$1.00**

HOW TO ORDER . . . GIVE PART NUMBER AND DESCRIPTION . . . ADD POSTAGE FOR WEIGHT SHOWN. NO ORDERS UNDER \$2.00 . . . WE WILL SHIP C.O.D.

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NEW YORK CITY (16)  
CABLE: ARLAB-N.Y.

**The HEATH COMPANY**  
... BENTON HARBOR 15, MICHIGAN



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chunk of money with JFD  
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right, our quality is right,  
our prices are right.



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List

**JFD**  
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**"QUIK-RIG"**  
**TV ARRAY**

All-Channel Duo-Orienting Hi-Lo  
array. As easy to assemble as  
opening an umbrella. Another  
JFD "Economy" value!



**JFD**  
**STAND-OFF INSULATORS**  
**What a Variety!**

Most Lead-In Stand-Offs  
Screw-Thru Insulators  
Double Screw-Thru Insulators  
Drive-In Insulators  
Snap-On Insulators  
Single Screw-eye Stand-Offs  
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Double Most Lead-In Stand-Offs  
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**JFD Steel Antenna**  
**Extension Masts**

Elevate antennas simply  
and swiftly. No coupling  
accessories necessary.  
Outside-Inside Rust-  
Resistant Finish. 1 1/4"  
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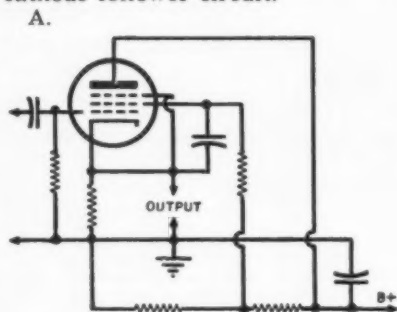
# DO YOU KNOW?

By DAVID SCOTT

113. What are the characteristics  
of a cathode follower circuit?

A. A cathode follower circuit has  
no gain, inherent inverse feedback,  
or low output impedance, and one  
end of its output is at ground po-  
tential, making it very adaptable to  
coaxial cable circuits.

114. Draw a simple schematic of a  
cathode follower circuit.



115. How may noise factors be kept  
low in amplifier designs?

A. Thermal noise and shot effect  
is kept at a minimum by using low  
values of coupling resistors and low-  
current tubes, especially in the first  
stage, or whenever the signal is less  
than ten millivolts.

116. What is the purpose of delib-  
erately using non-linear or distort-  
ing amplifiers?

A. Distorting amplifiers are used  
to introduce changes to the over-all  
gamma of a picture and is done by  
varying the bias voltage to operate  
a different portion of the  $I_p-E_s$   
curve.

117. What are the three important  
considerations of coaxial cable?

A. Coaxial cable considerations  
are: (1) Surge impedance; (2) at-  
tenuation-amplitude-frequency re-  
sponse, and (3) time delay-phase-  
frequency response.

118. What is the bandwidth of a  
television channel?

A. Six mc. includes the video and  
audio signals and their respective  
carriers and guard bands.

119. What is the purpose of a single  
sideband transmission.

A. With a normal double side-  
band transmission symmetrically  
disposed about the carrier, a fre-  
quency deviation of only 2.5 mc. on  
each side of the carrier would be  
practical with a 6 mc. channel  
width. By moving the carrier to  
within 1.25 mc. of the lower limit  
of the channel and shaving the low-  
er sideband off, a frequency swing  
of 4.5 mc. is possible, thereby  
providing greater picture detail.

120. What is meant by quasi-single  
or vestigial sideband transmission?

A. A band elimination filter hav-  
ing too sharp cut-off characteristics  
would induce bad phase shifts.  
Therefore, the cut-off characteristic  
is tapered so that about 1.25 mc. of  
the lower sideband is left. This is  
called "quasi-single" or "vestigial"  
sideband transmission.

121. How far may a television sig-  
nal be transmitted?

A. The effective range of a tele-  
vision signal is usually taken as the  
"line-of-sight" distance that can be  
seen from a transmitter antenna to  
receiver antenna. This is not a  
hard and fast rule, however, just a  
practical one.

122. What is meant by carrier pol-  
arization?

A. Polarization is the direction  
of the electric field relative to the  
earth's surface. Vertical antennas  
produce vertically polarized waves;  
horizontal antennas produce hori-  
zontally polarized waves.

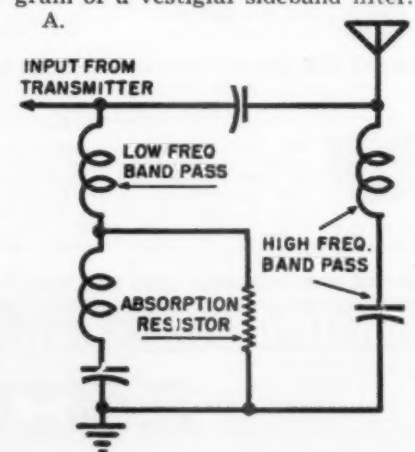
123. What is the effect on the im-  
pedance of an open circuit on a  
quarter-wave section of coaxial  
cable?

A. If a quarter-wave section of  
coaxial cable is open circuited at  
the far end, it has very low imped-  
ance at the near end.

124. What is the effect on the im-  
pedance of a short circuit on a  
quarter-wave section of coaxial  
cable?

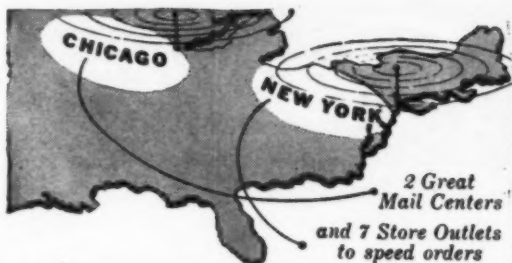
A. If a quarter-wave section of  
coaxial cable is short-circuited at  
the far end, the near end impedance  
is very high.

125. Draw a simple schematic dia-  
gram of a vestigial sideband filter.



(To be continued)





# Lafayette

## RADIO ELECTRO NEWS

★ ★ ★ ★ 29 YEARS SERVING & SAVING MONEY AND TIME FOR 500,000 HAPPY CUSTOMERS ★ ★ ★ ★

## NEW CATALOG SO HOT IT NEEDS ASBESTOS COVERS!

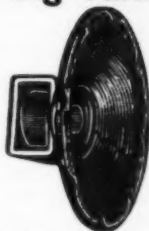
### 5 SPEAKER BARGAINS—Big Values Speak Volumes!



#### 15" PM SPEAKER

Here's Mr. Big among speakers. 25-watt rating guarantees power to spare with a minimum of distortion. Massive 1½ lb. permanent magnet; 6 to 8 ohm voice coil; extended bass and treble range. Dollars less than anything in its class!

No. 99N7034R **\$1295**  
(weight: 9 lbs.)



#### 12" RCA SPEAKER

Where else can you buy a genuine, brand new RCA 12" speaker at this price? 15 watt capacity. 6.8 oz. Alnico V magnet. Voice coil impedance of 3.2 ohms. A terrific value. Don't pass it up.

No. 99N7023R (weight: 6 lbs.) **\$475**

#### 10" ALNICO PM SPEAKER

Fine performance at a new low in price. 10 watt cap. 6.8 oz. Alnico V magnet. Voice coil impedance of 3.4 ohms.

No. 99N7019R (weight: 5 lbs.) **\$315**

#### 4" x 6" OVAL SPEAKER

Alnico V 1.47 oz. 3½" x 4½" mounting centers. Dustproof cap. 3-4 ohms V.C. impedance. Rated 3 watts, 4½ peak. Less transformer.

No. 99N7012R (weight: 3 lbs.) **\$129**

#### 12" ALNICO PM SPEAKER

Handles 14 to 18 watts with excellent sound quality. 6.8 oz. Alnico V magnet, 6-8 ohm voice coil. Ideal for use with FM receiver or P.A. system.

No. 99H7010R (weight: 6 lbs.) **\$595**

### IT'S FREE!



**BUMPER CROP OF VALUES**  
**PROVE U-PAY LESS AT**  
**LAFAYETTE!**

### SAVE ON THESE 2 MOTORS

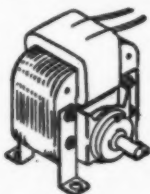
EVEN  
SPEED



#### PHONO MOTOR

Rim-driven. 9" turntable. Constant speed (78 rpm), self-starting. 110 V., 60 cycles only.

No. 99N8003R (weight: 6 lbs.) **\$225**



#### 1/20 HP MOTOR

Many uses for this fine 1/20 hp motor. 2900 rpm. 115 v., 50-60 cycles, AC. ¼" x 2½" x 3½" high. Shaft ¼" dia., ¾" long.

No. 99N7079R (weight: 3 lbs.) **\$389**

#### DELCO VOLUME CONTROLS



STOCK NO.	OHMS	PRICE EACH
99N2153R	50,000	24c
99N2157R	100,000	24c
99N2160R*	300,000	22c
99N2161R	500,000	27c
99N2162R	600,000	27c
99N2165R	1 Megohm	27c
99N2167R	2 Megohm	27c
99N2168R	3 Megohm	27c
99N2172R	500,000 tapped at 100,000	29c
99N2174R*	500,000 tapped at 200,000	27c
99N2176R	1 Megohm tapped at 100,000	29c
99N2177R*	1 Megohm tapped at 200,000	27c
99N2181R	SPST Snap-on Switch	8c

\*Will not take switch



#### POWER TRANSFORMER

A real bargain! Single shell mtg. electrostatically shielded. Extruded shell for 2-hole mounting. Primary 117 V. 50/60 cycles. Secondary output: 600 V. CT at 50 mil. 6.3 V. at 2A, 5V. CT at 2A. Color-coded leads.

No. 99N5156R (weight: 3 lbs.) **\$139**

#### NAME BRAND 6-VOLT VIBRATOR

Popular universal 4-prong vibrator—replaces the great majority of vibrators, including Mallory 294, 4-4, Radiart 5300, SO-1, Utah NP-42, Delco 5,040,000, 5,052,378 and Meissner EO1. Stock up and save!

No. 99N3950R (weight: 8 oz.) **\$98c**

Here's  
Value!

Special  
Buy!



#### FILTER CHOKE

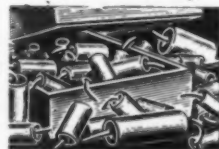
Excellent quality 25 Henry Filter Choke. 60 M.A., 200 ohms DC resistance. Unshielded, strap type mounting. Overall dimensions 2½" x 2" x 1½". Mtg. center 2½".

No. 99N5155R (weight: 8 oz.) **\$49c**

#### CONDENSER KIT Buy!

Pick up 25 top quality tubular condensers for a song. Wax impregnated, non-inductively wound. From .002 mfd. to .5 mfd. Long, flexible pigtail leads. Meets RMA standards.

No. 99N278R (weight: 1½ lbs.) **\$97c**



Whether you're a service man, ham, advanced amateur or beginner, you'll find this practical encyclopedia of Electronic Equipment the most useful "tool" in your kit! All the latest on Television, High Fidelity Radio and Phonograph Systems, P. A., Test Equipment, Parts, Tools, Electrical Appliances, etc., etc.

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# What's New in Radio

## ASTATIC BOOSTER

Heretofore a manufacturer of microphones, phonograph pickups, cartridges, and related equipment, *The Astatic Corporation* of Conneaut,



Ohio, has entered the television field with the production of a television booster utilizing four tubes.

With high gain the principal feature of this Model AT-1 booster, coverage of all 12 television channels is attained without peaking or drop-off. Dual tuning controls that permit separate adjustment without sacrifice of signal quality are also said to minimize, or eliminate, interference by means of the added selectivity. Another aspect of the booster is the variable gain control preventing picture distortion when signal input is in excess of the amount required.

A self-contained power supply operates from 115 volt, 60 cycle a.c. power lines. The cabinet is in mahogany, with a furniture finish.

## CODE PRACTICE SET

Intended for use by radio hobbyists, amateurs, and even professionals, a new type of telegraphic code practice set produced by the *Martin Manufacturing Company* uses only one 1½ volt flashlight cell.

Called the "Duplex Practicode," this set has a 4-inch PM speaker and is



complete with a professional telegraph key and flashlight cell. It is portable and external terminals are included for long distance operation,

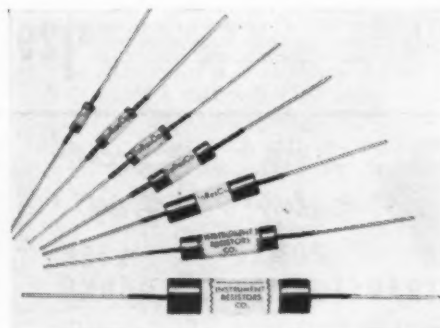
so that as many as six sets may operate on one line.

Although it is priced at \$8.95, it is not a toy and is absolutely safe for anyone to use. It generates an "easy-to-copy" tone, and its high volume is said to be comparable to the d.c. note obtainable from professional sets. Write the company at 194 Gelston Avenue, Brooklyn 9, N. Y., for information.

## MIDGET RESISTORS

Special features of the *Instrument Resistors Company* midget size wirewound resistors are the enameled wire used, the special Bakelite form that eliminates shrinking, swelling and temperature effects, and the moisture and fungus proof coating.

The company, located at 1036 Commerce Avenue, Union, New Jersey, announced that its new resistors meet all requirements where precision resistance values and exceptionally



small size must be utilized at lowest cost. Although they are no larger than molded resistors, these Type IR units are wirewound to a standard tolerance of plus-minus 1 per-cent, and maintain this accuracy indefinitely.

Complete details on the IR types (inductive) and the IRN types (non-inductive) can be obtained from the company.

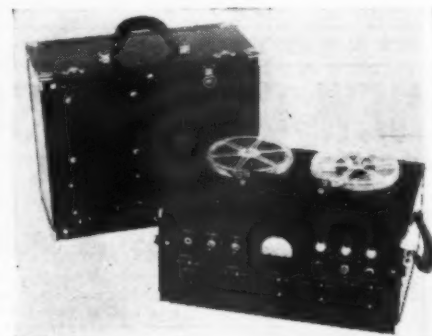
## COMMERCIAL TAPE RECORDINGS

Musical concerts, professionally recorded on magnetic tape, are now being produced by the *Amplifier Corporation of America*, 398-2 Broadway, New York, N. Y.

In conjunction with Vox and Polydor, *Amplifier Corp. of America* has secured exclusive rights to the finest transcriptions in the musical libraries of these prominent European studios. Special equipment designed by the company is used in copying.

Recordings of one hour duration are available for dual-track recorders, and half-hour recordings may be had for single-track units. To accommodate most of the tape units now in use, recordings are made at the

standard RMA tape speed of 7½ inches per second.



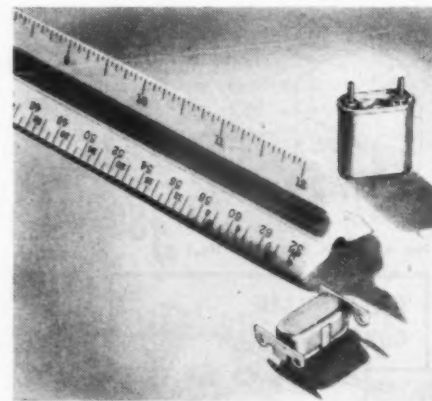
A catalogue of programs may be secured by writing to the company.

## STEVENS THERMOSTATS

A positive operating thermostat, designed for precise control of low-wattage electrical circuits, is being produced by the *Stevens Manufacturing Company, Inc.*, Mansfield, Ohio.

Adapted for communications and electronic equipment and appliances, this unit may be utilized alone or in conjunction with disc type thermostats. A wide variety of terminal arrangements is in production, in many operating ranges up to a maximum of 600 degrees F. Temperatures as low as minus 60 degrees C. do not impair normal operation.

In the *Stevens* line, two styles are available: the standard, which is semi-sealed, and the type that is hermetically sealed in a metal enclosure.



All of the thermostats are pre-calibrated in pots, simulating actual service conditions before shipment.

## MAGNASCREEN ENLARGER

A strong and light-weight plastic is the material used in the MAGNASCREEN made by the *Plastics Division of Willson Camera Co.*, Philadelphia, Pa. This marks a new approach to the production of large-size images from television screens of nominal dimensions.



The MAGNAScreen, framed in mahogany or walnut, comes in three sizes, 8 by 10 inches, 9 by 12 inches, and 11 by 16½ inches. Weight of the largest size is less than 3 pounds, in-



cluding frame and mounting brackets. To illustrate the principle, mounting the screen in front of a 10-inch screen, the image can be enlarged to the size of a 16-inch tube.

#### NEW TV TUBES

Recently the receiving tube division of Raytheon Manufacturing Company, 55 Chapel St., Newton 58, Mass., announced production of two tube types, the 1X2, a filament-type rectifier, and the 6BQ6GT, a beam pentode, for use in television receivers.

As a high-voltage rectifier in TV tubes or in r.f., fly-back, and power

line frequency types of rectifier circuits, the 1X2, of miniature construction, can be utilized to advantage.

The 6BQ6GT is designed for use as a horizontal deflection amplifier. By employing a T-9 bulb and a standard octal base, space may be saved by use of the 6BQ6GT. The plate connection through a top cap allows for better isolation of the high plate voltage.

#### SEQUENCE SELECTOR

In line with the recent FCC u.h.f. allocations, the Radio Craftsmen, Inc., 1617 S. Michigan Ave., Chicago, Ill., have designed a "Sequence Selector" which will permit the service technician to align a TV set to any of the new frequencies, as well as in any sequence or combination of u.h.f. or v.h.f.

The device is one of the features of the Craftsmen RC-100 receiver now being produced as a solution to "fringe area" problems. This new model is suitable for custom installation in cabinets, or in wall panels.

When setting the converter, all the service technician need do is arrange a number of cartridges in the sequence desired by the set owner, without regard to the channel number of the station.

#### TRAVELING WAVE AMPLIFIER

A valuable tool to use in the field of nuclear physics and as an amplifier for wideband oscilloscopes is the Model 202P amplifier manufactured by the Spencer-Kennedy Laboratories, Inc.,

186 Massachusetts Ave., Cambridge 39, Mass. The regulated power supply has a gain of 20 db. with a bandwidth of 200 mc. and insures constant gain within 1 per-cent, plus or minus, for line voltage variations of plus or minus 10 per-cent.

The combination of a linear phase shift and rise time of .003 microseconds makes this chain amplifier ideal for radar, oscillography, and high speed pulse amplification. The stabilized gain and four volts output make it well adapted for use as a preamplifier for signal, sweep and pulse generators,

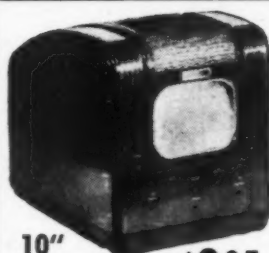


vacuum tube voltmeters, TV testing, and general laboratory measurements.

Chassis of the Model 202P is of lightweight aluminum, size 3½ by 19 by 11 inches, and it can be either rack or table mounted.

#### "PROSPECTOR" DETECTOR

Possessing both ruggedness and sensitivity for field operation, a uranium and radioactivity detector called the "Prospector," has been designed by the Kelley-Koett Manufacturing Company, (Continued on page 124)



10" TV CABINET \$995

Stock No. RY-10

Buy this 10" streamlined mahogany television cabinet at less than the cost of manufacturer. Originally intended for use with the Farnsworth GVZ-60 television chassis, pictured to the right. It is already drilled to fit. Built-in safety shield in front. All new, size 13 x 19½ x 17" high. Shipping weight 33 pounds. Stock No. RY-10. Net \$9.95. Order this cabinet by itself or order on combination deal.

## McGee's TV SCOOP!



FARNSWORTH Partially Built-Up CHASSIS

\$295

Stock No. GVZ-60

Farnsworth Television Chassis Model GVZ-60 partially built-up Chassis Size 12 x 17. Has 16 tube sockets and over 150 small parts (Resistor and Ceramic Condensers) no coils or Transformers or tuning unit. Sweep and sync. circuits are all partially wired up. This TV Chassis is ideal for the student and experimenter. Learn TV by building your own set, using this chassis to start from. Purchased with a 1948 regular \$3.00 Supreme Publications Television Manual, which has a complete schematic of this chassis as well as 9 pages of service information. Farnsworth GVZ-60 partially built-up Chassis and 48 Supreme TV Manual all for... \$5.95 Include postage for 11 lbs. GVZ-60 Chassis only \$2.95.



Sarkes-Tarzan TV TUNER \$995

Stock No. SK-T3

SARKES-TARZIAN, 12 channel television station selector, furnished complete with tubes—6C4, 6AG5 and 6BH6. Built-in fine frequency control. Everything wired up. Furnished with diagram, a \$20.00 value for \$9.95. Stock No. SK-T3. Weight 2 lbs. Net \$9.95. Stock No. IT-SK3. Identical to SK-T3, except has no fine frequency control. Net \$7.95.

Cabinet, Chassis and 13 Channel Tuner ALL FOR \$1795

#### BUY ALL 3 ITEMS PICTURED TO THE LEFT

Television combination deal—RY-10, 10" TV Cabinet; GVZ-60, partially built-up TV Chassis and SK-T3 Sarkes-Tarzan TV Tuner. These pieces bought separately add up to \$22.85. Total shipping weight, 45 lbs. Stock No. TV-JB, all three for only \$17.95. If 1948 Supreme TV Manual is desired, add \$3.00.



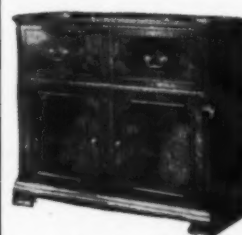
TELEVISION MAGNIFIER \$995 Regular \$25.00—FOR ONLY

Stock No. HA-22, 12-inch x 17-inch Television Magnifier. Made of crystal clear plastic and oil-filled. Magnifies your present 7-, 10- or 12-inch television picture up to four times. We offer you these new factory cartoned magnifiers. You provide your own means of mounting to your TV set. Edge of magnifier may be drilled and hung on set with cord. This lens is a \$25.00 value, but McGee offers it to you for only \$9.95. When ordering, include postage for 22 lbs.

McGEE RADIO COMPANY 1422 GRAND AVE. KANSAS CITY, MO.

Prices F.O.B. Kansas City

C.O.D. Orders Require 25% Deposit



OLYMPIC 10-TUBE FM/AM

Reg. \$350.00 List Phono Comb.

\$9950

Less Record Changer

Olympic 10-tube FM/AM chassis with 3-gang tuning condenser on both. 12" speaker, push-pull 6K6 high fidelity audio (10 watts output), attractive slide rule dial, tone control. 18th Century English Period Honduras Mahogany Cabinet. Brand new factory cartoned, priced F.O.B. New York. Chassis is mounted and changer board is cut for Webster 56 changer, but set is shipped less changer. This is the finest. Made to retail for \$350.00. Olympic model 7-925 FM/AM chassis and cabinet, less record changer, all for \$99.50. Limited quantity available.

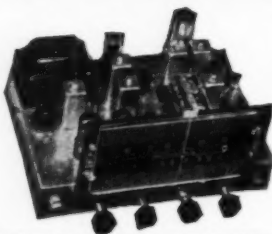
3-SPEED AUTOMATIC RECORD CHANGER A regular \$33.20 net item. (Changer board in cabinet can be cut out to accommodate.)

\$24.95 when ordered with Olympic



# HALLICRAFTERS S-56 11 TUBE FM-AM CHASSIS \$59.95

- ★ Wide Range Audio 50 to 14,000 C.P.S.
- ★ Automatic Frequency Control on F.M.
- ★ Input for Phono Pick-Up
- ★ Pre-selection on Broadcast Band
- ★ Latest Hallicrafters Production
- ★ In Original Factory Cartons
- ★ Regular \$110.00 Dealers Net
- ★ Order Your S-56 with a P.M. Speaker



FM-AM HALLICRAFTERS  
S-56 NOW AVAILABLE AT  
McGEE \$59.95

## S-56 WITH 12" 21 OZ. P.M. \$74.95

Hallicrafters S-56 chassis with tubes, 500 ohm to speaker matching transformer and our model A-50 super heavy duty 12 inch 21 oz. Alnico V PM speaker (regular \$50.00 list). This gives you the complete radio for custom installations. Shipping weight 36 lbs. Stock No. S-56A50: A-50 speaker \$8.56 and transformer all for \$74.95.  
G.I. Dual Speed Changer Stock No. GI-73 \$17.95 extra.

## S-56 WITH 12" COAXIAL P.M. \$71.95

Hallicrafters S-56 chassis with tubes, 500 ohm to speaker matching transformer and our model CR-13X 12 inch coaxial PM wide range speaker. This gives you a complete radio for custom installations. Shipping weight 33 lbs. Stock No. S-56CR13X: CR-13X speaker S-56 and transformer all for \$71.95.  
G.I. Dual Speed Changer Stock No. GI-73 \$17.95 extra.

## S-56 WITH 15" JENSEN P.M. \$79.95

Hallicrafters S-56 chassis with tubes, 500 ohm to speaker matching transformer and model A-15 PM Jensen 15 inch 6 lb. magnet speaker. This gives you a complete radio for custom installations. Shipping weight 47 lbs. Stock No. S-56A15PM: Jensen Speaker S-56 and transformer all for \$79.95.  
G.I. Dual Speed Changer Stock No. GI-73 \$17.95 extra.



WEBSTER  
CHICAGO  
MODEL 356  
NET \$17.88



WEBSTER  
CHICAGO  
MODEL 356  
NET \$33.59

Webster Chicago Model 356 3-Speed Automatic Record Changer. Plays all records automatically. Tension Tip needle with quick change lever. This is the finest 3-Speed changer on the market. Net \$33.51.  
Webster Chicago 77-1. Plays 7" records either 14 or 45 RPM automatically. Base size 10 1/2 x 7 1/2 x 3 1/2 above and 3 1/2 below. Net \$17.88. Spiders for RCA records 10 for \$25.

## G.I. DUAL SPEED CHANGER WHEN PURCHASED WITH S-56 OR S-59 \$17.95

General Instrument Dual speed automatic record changer plays 10-12" or 12-10" 33 1/3 or 78 RPM records automatically. Latest model with static reversible cartridge and permanent needle. While our stock lasts we offer this changer, Stock #GI-73 for only \$17.95 when purchased with S-56 or S-59 Hallicrafters or \$19.95 when purchased by itself. Weight 11 lbs.

## PLASTIC BY-PASSES

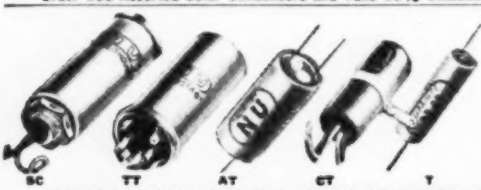
SOLAR OR EQUAL - Tubular By-Passes. All plastic and branded - 600 volt rated. .001, .002, .005, .01, .02, .1, .12.  
each 10c: .05, 11c: .1, 12c.



## SOLAR METAL F.P. CONDENSERS POPULAR TWIST MOUNTING IN ALUMINUM CANS

8 Mfd. 450 volt PP condenser.....	25c	25-25 Mfd. 25v PP.....	15c
16 Mfd. 450 volt PP condenser.....	34c	40-40 Mfd. 20 25v PP.....	15c
20 Mfd. 450 volt PP condenser.....	39c	40-40 Mfd. 150v PP.....	29c
30 Mfd. 450 volt PP condenser.....	39c	24-16 Mfd. 350v.....	39c
20 Mfd. 450 volt PP cond. Special.....	20c	20-10 Mfd. 350v.....	39c
30 450v. 20 25v PP.....	39c	18-15 450v 20 25v.....	59c
40 250v. 20 25v PP.....	19c	40-40 Mfd. 450v.....	59c

Order 100 Assorted Solar Condensers and Take 10% Discount from Above Prices.



## NATIONAL UNION CLOSE-OUT SALE

ORDER \$100.00 WORTH—TAKE 10% OFF ON N.U. COND.  
NATIONAL UNION TYPE AT AND GT—ALL FRESH STOCK  
AND BOXED—1 YEAR GUARANTEE

10 MFD. 25v. 15c	50 MFD. 150v. 35c	4 MFD. 450v. 20c	40-20 150v.....35c
25 MFD. 25v. 20c	16 MFD. 150v. 35c	16 MFD. 450v. 40c	50-30 150v.....80c
100 MFD. 25v. 25c	8x 8 450v. 40c	30 MFD. 450v. 80c	80-40 150v.....40c
24 MFD. 150v. 30c	16x16 450v. 50c	20-20 150v.....30c	20-20 450v.....60c

**NATIONAL UNION ALUMINUM CAN "TWIST TAB" TYPE TT**  
National Union Type TT Electrolytic Condensers. Aluminum can F.P. type Twist Tab mounting common negative grounded to can. Individually cartoned in green N.U. boxes. Each condenser supplied with 1 bakelite insulating plate and 1 metal grounding plate. Save over half on these. All sizes and one-year guarantee.  
100 MFD. 25v.....15c  
500 MFD. 25v.....19c  
10 MFD. 450v.....25c  
20 MFD. 450v.....30c  
30 MFD. 450v.....40c  
40 MFD. 450v.....50c  
80 MFD. 450v.....60c  
20-20 MFD. 150v. 30c  
40-40 MFD. 150v. 40c  
50-50 MFD. 150v. 50c  
80-40 MFD. 150v. 60c  
10-10 MFD. 450v. 40c  
16-16 MFD. 450v. 45c  
40-40 MFD. 450v. 60c  
10-10-10. 450v. 70c  
10-10-10-10. 450v. 70c

**100-600V. BY-PASSES, \$6.95  
MAKE YOUR OWN ASSORTMENT**  
T .0001. T .00025. T .0005. T .001.  
T .002. T .005. T .008-5c Each.  
T .02. T .03. T .04-6c Each.  
T .05-7c Each; T .1-8c Each.  
T .25-10c Each; T .5-15c Each.



**N.U. CONTROLS  
100 for \$29.25**  
Individually cartoned volume controls, all have on-off switch attached.  
NU 5M-A 5,000 OHM 24c  
NU 10M-B 10,000 OHM 24c  
NU 25M-A 25,000 OHM 24c  
NU 50M-B 50,000 OHM 29c  
NU 100M-B 100,000 OHM 29c  
NU 250M-TX 250,000 OHM Tapped 29c  
NU 500M-TX 500,000 OHM Tapped 39c  
NU 1 MEG-TX 1 MEG OHM Tapped 39c  
NU 2 MEG-TX 2 MEG OHM Tapped 39c  
NU 500M-CB 500,000 OHM 39c  
100 National Union Controls \$29.25. Assorted as follows: 25 of the 1st 3 Types, 25 of the 2nd 3 Types, and 50 of the last 4 Types.

## CAPEHART CHANGER SCOOP \$6.95

While our stock lasts we offer these Capehart changers for only \$6.95. These changers are in good condition, but have been removed from sets to make way for 3 speed changers. They need adjusting, however, you service men with a little ingenuity can put them to profitable use. These changers are equipped with True Timber Variable Resistance Cartridge with permanent needle. (Requires same gain as G.E. Variable Reluctance.) Connecting instructions furnished. Shipping weight 23 lbs. Extra pick up arm with Standard Crystal Cartridge \$1.00 extra.  
Base size 14 1/2 x 14 1/2. Stock No. NK-3. Net \$6.95 each. 2 for \$12.95.

## TAKE YOUR PICK OF THESE CHANGERS \$12.95

<b>VM-400 \$12.95</b> CRESCENT Model 350 with Astatic L-70 cartridge. Plays 10-12" or 12-10" records at 78 RPM. Base size 11 1/2 x 13". Net Price \$12.95. Two for \$25.00. A red hot changer value. Weight 14 lbs.	<b>CRESCENT 350 \$12.95</b> CRESCENT Model 350 with Astatic L-70 cartridge. Plays 10-12" or 12-10" records at 78 RPM. Base size 11 1/2 x 13". Net Price \$12.95. Two for \$25.00. A red hot changer value. Weight 14 lbs.	<b>FARNSWORTH \$12.95</b> FARNSWORTH, triple top changer, with Caltron V.R. cartridge; as used on top price radio. Shuts off on last record. Base size 12 x 14 1/2. 78 RPM. Net Price \$12.95; two for \$25.00. Weight 18 lbs.	<b>STEWART-WARNER</b> AERO—Made for STEWART-WARNER. Plays 10-12" or 12-10" records at 78 RPM. With Webster swivel-action cartridge and permanent needle. Base size 12 1/2 x 13 1/2. 78 RPM. Net Price \$12.95; two for \$25.00. Weight 12 lbs.
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MADE TO FIT LEATHERETTE COVERED BASES. May Be Ordered with Any Changer Advertised. Only \$1.95

## WEBSTER-56 \$14.95

Webster Chicago Model 56. Without a doubt one of the best 78 RPM Record Changers. On the market while our limited stock lasts. Weight 18 lbs. \$14.95 each.  
This Changer is small, easy to service and used on innumerable original equipment sets. Weight 12 lbs. Net \$12.95. Two for \$25.00.



General Industries Recording heavy duty phono motor with T.T. 78 RPM. Scoop price..... \$9.95  
Deluxe quality 78 RPM phono motor with T.T. \$2.95  
Dual speed phono motor 33 1/3 or 78 Reg. \$11.00 list. scoop price..... \$4.95  
Dual speed phono motor 33 1/3 or 78 Reg. \$11.00 list. scoop price..... \$4.95

## 100 RADIO TUBES \$29.95

250,000 Tubes for fast sale. Tremendous value. Tubes up to \$3.00 list. 100 Cartoned and branded Hyvac Mixture Tubes for \$29.95. Over a million sold. Guaranteed full replacement. 34c Each in smaller quantities.

12A6	12BE6	12BA6	6SU7	1250
12A7	12AT6	12AV6	6X4	6001
12A8	12B6	6BA6	6AQ6	9002
12A9	12B7	6BE6	6C4	68B6
12B6	12B7	6B7	6W4	68C6
12B7	12B7	6A7	6A7	68D6
12B8	12B7	6A7	6A7	68E6
12B9	12B7	6A7	6A7	68F6
12B10	12B7	6A7	6A7	68G6
12B11	12B7	6A7	6A7	68H6
12B12	12B7	6A7	6A7	68I6
12B13	12B7	6A7	6A7	68J6
12B14	12B7	6A7	6A7	68K6
12B15	12B7	6A7	6A7	68L6
12B16	12B7	6A7	6A7	68M6
12B17	12B7	6A7	6A7	68N6
12B18	12B7	6A7	6A7	68O6
12B19	12B7	6A7	6A7	68P6
12B20	12B7	6A7	6A7	68Q6
12B21	12B7	6A7	6A7	68R6
12B22	12B7	6A7	6A7	68S6
12B23	12B7	6A7	6A7	68T6
12B24	12B7	6A7	6A7	68U6
12B25	12B7	6A7	6A7	68V6
12B26	12B7	6A7	6A7	68W6
12B27	12B7	6A7	6A7	68X6
12B28	12B7	6A7	6A7	68Y6
12B29	12B7	6A7	6A7	68Z6
12B30	12B7	6A7	6A7	68A7
12B31	12B7	6A7	6A7	68B7
12B32	12B7	6A7	6A7	68C7
12B33	12B7	6A7	6A7	68D7
12B34	12B7	6A7	6A7	68E7
12B35	12B7	6A7	6A7	68F7
12B36	12B7	6A7	6A7	68G7
12B37	12B7	6A7	6A7	68H7
12B38	12B7	6A7	6A7	68I7
12B39	12B7	6A7	6A7	68J7
12B40	12B7	6A7	6A7	68K7
12B41	12B7	6A7	6A7	68L7
12B42	12B7	6A7	6A7	68M7
12B43	12B7	6A7	6A7	68N7
12B44	12B7	6A7	6A7	68O7
12B45	12B7	6A7	6A7	68P7
12B46	12B7	6A7	6A7	68Q7
12B47	12B7	6A7	6A7	68R7
12B48	12B7	6A7	6A7	68S7
12B49	12B7	6A7	6A7	68T7
12B50	12B7	6A7	6A7	68U7
12B51	12B7	6A7	6A7	68V7
12B52	12B7	6A7	6A7	68W7
12B53	12B7	6A7	6A7	68X7
12B54	12B7	6A7	6A7	68Y7
12B55	12B7	6A7	6A7	68Z7
12B56	12B7	6A7	6A7	68A8
12B57	12B7	6A7	6A7	68B8
12B58	12B7	6A7	6A7	68C8
12B59	12B7	6A7	6A7	68D8
12B60	12B7	6A7	6A7	68E8
12B61	12B7	6A7	6A7	68F8
12B62	12B7	6A7	6A7	68G8
12B63	12B7	6A7	6A7	68H8
12B64	12B7	6A7	6A7	68I8
12B65	12B7	6A7	6A7	68J8
12B66	12B7	6A7	6A7	68K8
12B67	12B7	6A7	6A7	68L8
12B68	12B7	6A7	6A7	68M8
12B69	12B7	6A7	6A7	68N8
12B70	12B7	6A7	6A7	68O8
12B71	12B7	6A7	6A7	68P8
12B72	12B7	6A7	6A7	68Q8
12B73	12B7	6A7	6A7	68R8
12B74	12B7	6A7	6A7	68S8
12B75	12B7	6A7	6A7	68T8
12B76	12B7	6A7	6A7	68U8
12B77	12B7	6A7	6A7	68V8
12B78	12B7	6A7	6A7	68W8
12B79	12B7	6A7	6A7	68X8
12B80	12B7	6A7	6A7	68Y8
12B81	12B7	6A7	6A7	68Z8
12B82	12B7	6A7	6A7	68A9
12B83	12B7	6A7	6A7	68B9
12B84	12B7	6A7	6A7	68C9
12B85	12B7	6A7	6A7	68D9
12B86	12B7	6A7	6A7	68E9
12B87	12B7	6A7	6A7	68F9
12B88	12B7	6A7	6A7	68G9
12B89	12B7	6A7	6A7	68H9
12B90	12B7	6A7	6A7	68I9
12B91	12B7	6A7	6A7	68J9
12B92	12B7	6A7	6A7	68K9
12B93	12B7	6A7	6A7	68L9
12B94	12B7	6A7	6A7	68M9
12B95	12B7	6A7	6A7	68N9
12B96	12B7	6A7	6A7	68O9
12B97	12B7	6A7	6A7	68P9
12B98	12B7	6A7	6A7	68Q9
12B99	12B7	6A7	6A7	68R9
12B100	12B7	6A7	6A7	68S9

HYVAC-12A7GT, 12SK7GT, 12SQ7GT, 35L6GT, 50L6GT, 30c each. These types are more costly and cannot be included in the 100 for \$35.00 deal. They net you 39c each.

## STANDARD BRAND TUBES and CARTONED 49c

024G	106	5V4	6T7	6A7	6T7	789	757	125	1250	20	43	68E6
1A4	106	5Y3	6J5	6SC7	6V6	7C4	7V7	12N6	12SR7	27	4525	50V7
1A6	106	6A3	6J5	6SD7	6X5	7C5	7Y4	12N6	12SR7	27	50M5	41
1B4	114	6AB7	6J7	6SF5	6V6	7C5	7Z4	12K8	1A4T	32	56	35B5
1B5	115	6AC7	6K5	6SF7	6Z7	7C7	10Y	12Q7	1A86	33	57	30A4
1C2	135	6AG7	6K5	6SG7	6Z7	7E5	12A6	12SC7	1A47	34	58	1A4A
1C7	174	6B8	6K7	6SH7	7A4	7E7	12A8	12SC7	1A47	34	58	1A4A
1D5	1V4	6C4	6K8	6SJ7	7A5	7F7	12A7	12SC7	1A47	35	70L7	12J7
1D7	2A5	6C5	6L5	6SK7	7A6	7H7	12A7	12SC7	1A47	35	70L7	12J7
1D8	2A6	6C6	6L7	6SL7	7A7	7J7	12A6	12SC7	1A47	35	70L7	12J7
1F4	2A7	6D6	6N7	6SQ7	7B4	7H7	12B6	12SJ7	25L5	35	75	35
1F5	3A4	6D8	6N7	6SR7	7B5	7J7	12B6	12SJ7	25L5	35	75	35
1G4	374	6F5	6S7	6SS7	7B6	7K7	12C4	12SN7	25L5	35	75	35

## NAME BRAND 1 1/2 VOLT LOCALS, ETC.

1L5	1L5	1L4	1L5	1L6	1L7	1L8	1L9	1L10	1L11	1L12	1L13	1L14	1L15	1L16	1L17	1L18	1L19	1L20	1L21	1L22	1L23	1L24	1L25	1L26	1L27	1L28	1L29	1L30	1L31	1L32	1L33	1L34	1L35	1L36	1L37
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# "COAXIAL" 12 INCH SPEAKER \$12.95

## ALNICO V MAGNETS

RESPONSE 40-17000 G.P.S.

Molded High Fidelity Cone

Nationally Famous Maker

12 and 15 INCH SIZES

12-INCH COAXIAL SPEAKER  
MODEL CR-13X



REGULAR  
\$32.50  
LIST

12 INCH COAXIAL SPEAKER

MODEL CR-13X \$12.95

15 INCH KING COAXIAL

MODEL 5-15X \$24.95

Newly designed by one of America's finest speaker builders. Made for FM and AM high fidelity radios and record players. This speaker is incorporated in radios of the 500 dollar bracket. It has an especially designed 12" 6.8 ohm Alnico V Magnet PM for low range Woofer and a coaxially built in 3" Alnico V tweeter for the extended high range. The high pass filter is concealed under the pot cover. Just hook to any 8 Ohm output transformer. Will work in place of any home radio speaker as most speakers have an 8 Ohm Voice Coil, only 2 wires to connect. Will handle 18 Watts peak. Wide range response 40 to 17,000 Cycles. This speaker should sell for \$35.00. Why buy any ordinary speaker when we offer a 12" Coaxial PM for only \$12.95. Shipping weight 8 lbs. Model CR-13X, \$12.95. Two for.....\$24.95

15 INCH KING COAXIAL SALE PRICE \$24.95

"IT WOOFs AS IT TWEETS"

The King Coax. A 21.5 oz. 15 inch Alnico V PM speaker with a built-in high frequency tweeter. Will respond to from 50 to 12,000 cycles. This is a ruggedly built speaker with a curvilinear one piece molded cone. Built-in high pass filter. Just hook to any 8 ohm output. Built by the maker of our ever popular 12 inch coax model CR-13X. This speaker has a retail list of over \$60.00. We offer you our 5-15X 15 inch coax for only \$24.95. Shipping weight 10 lbs.

HIGH FIDELITY OUTPUT TRANSFORMER \$6.95

Why not order with one of the above speakers?

6600 OHMS PLATE TO PLATE

Why pay \$20.00 or \$30.00 for an output? Supreme quality and high fidelity output transformer. Designed to match push-pull plates (2-6L6, 2-6V6, or 2-6AQ5) class AB, to 4-8-15-250 and 500 ohm; with 10% feedback winding. Based in a compound filled case: 3 1/2 x 4 1/2 x 3 1/2. Actual net weight, 6 lbs. If you want the best quality from your audio system, order this transformer. Response essentially flat from 20 to 20,000 cycles. We have tried several high fidelity outputs in our lab and find this to be the best value. Even though your amplifier only puts out 10 or 15 watts, this 34 watt job is what you should have. Connecting instructions are furnished. Stock No. A-403, shipping weight 8 lbs. Net price.....\$6.95

40 WATT CAPEHART HIGH FIDELITY

OUTPUT TRANSFORMER \$7.95

Stancor built for Capehart for this finest combination. 40 watt composite all windings interwound to increase high frequency response and decrease capacity losses. High inductance in coils makes for best efficiency at low audio frequency. This high fidelity output transformer is fully shielded and has a net weight of 6 lbs. Made to match push pull 6L6 tubes 5,000 ohm plate to plate. Has tertiary winding for 10% feedback and voice coil windings of 4 and 8 ohms. Frequency response plus or minus 2 db from 30 to 15,000 cycles. Down 6db below 20 cycles and above 20,000 cycles. Furnished with connecting instructions. Size 3 1/2 x 4 1/2 x 3 1/2. Shipping weight 8 lbs. Stock No. SX-55, net.....\$7.95

3000 SPEAKERS

450 OHM FIELD WITH

P.P. 6K6 OUTPUTS

HERE'S THE GREATEST

SPEAKER VALUE EVER

10" 450 ohm, with P.P. \$1.99

8" 450 ohm, with P.P. 1.99

6x3" 450 ohm, with P.P. 1.99

6K6 output.....\$1.99

All factory cartoned, \$1.99 each or buy 10 assorted for \$18.50. These speakers are produced for Majestic by Utah Celtron and Carbonara. Buy for less than half of the factory cost.

POPULAR FIELD COIL SPEAKERS

5" Utah 450 ohm speaker, with output for 50L6. This is a quality 5" speaker. Has full size coil and humbucking coil. A real special.....\$1.49

4x6" 450 OHM OPERADIO

Special, only.....\$9c

12" DYNAMIC BARGAINS

12" 450 ohm field speaker.....\$2.49

12" 210 ohm field speaker.....\$2.49

12" 400 ohm field speaker.....\$2.49

Some have outputs. All are fine speakers by Magnavox, Operadio, Oxford, etc. Hot-test special ever offered, each.....\$2.49

CHOKES FOR RECEIVERS

50 MA. AC-DC Choke. Special.....\$3.9c

75 MA. AC-DC Choke. Special.....\$4.9c

150 MA. Choke, fully shielded, 8 Henry. Special.....\$9c

Push-Pull 6L6's—5,000 Ohm Output

Transformers, Fully Shielded

1 1/2" core, Hi-Fi Output. Made for Capehart's best sets. Weighs 4 pounds. P.P. 6L6's to 8 ohm voice coil.....\$2.95

HEAVY DUTY P.M. SPEAKERS

IDEAL FOR AUTO SET REPLACEMENTS

6" square 3.16 ohm Alnico V magnet.....\$2.29

7" square 3.16 ohm Alnico V magnet.....\$2.49

8" square 3.16 ohm Alnico V magnet.....\$2.49

8" square 3.16 ohm Alnico V magnet.....\$2.99

All late production, not surplus. All have 8 1/2" voice coils and are made with a small square back to mount in any set.

5 1/2" UTAH and output

5 1/2" Utah PM, with 3Q5 output. Made for the famous overseas Zenith. Made with a 3 oz. magnet. A buy for only.....\$1.95

6 1/2" QUAM and output

6 1/2" Quam PM speaker. 2.15 ohm Alnico V, with 50L6 output transformer. A \$4.00 value. Special, only.....\$1.95

6" G.E. PM and output

6" G.E. PM speaker. 3 oz. Alnico V magnet, with 5000 ohm output transformer. A \$5.00 value. A honey for.....\$2.49

Here's a sizzler. 8" Utah PM, with 4.64 ohm Alnico V magnet and 1" voice coil. A \$5.00 wholesale value. Special.....\$2.95

FAMOUS 12" MAGNAVOX

Famous 12" Magnavox PM speaker. 21 oz. Alnico 3, heavy seamless cone. We have sold 10,000 of this fine speaker. Only 800. Very special, \$4.95; 5 for.....\$22.95

1,500 6 1/2" OPERADIO

6 1/2" Operadio PM speaker. 1.47 Alnico V magnet. We have 1500 of this beautiful speaker. Fully dust proofed. 6 1/2" PM made by Operadio. 1.47 ohm Alnico V PM. Buy a lead at this unheard-of price. Each \$1.29; 10 for only.....\$12.60

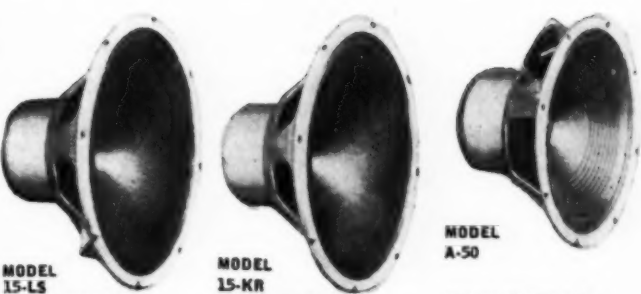
6" OXFORD and output

6" square Oxford. 1.5 ohm magnet, with P.P. output. Special, each.....\$1.79

20 to a carton. Buy 20 for only.....\$17.00

10" OXFORD PM SPEAKER

10" Oxford PM speaker. 7 oz. Alnico V magnet. Special, half price.....\$3.49



MODEL 15-L5  
15" 50 WATT P.M.  
\$16.95

MODEL 15-KR  
15" JUKE BOX  
\$9.95

MODEL A-50  
12" 50 WATT P.M.  
\$14.95

15 INCH DELUXE 50 WATT P.M. \$16.95

Model 15-L5. 15" 51 1/2 oz. Alnico V Magnet PM Speaker. Will take 35 watts with ease. Thousands of dollars were spent in building the fine tools to produce this speaker. The 8 ohm voice coil is 1 1/2" in diameter and has been heat treated and plastic coated. Constructed to eliminate loose voice coils, wires and warping. Made by renowned builder of fine speakers. Truly the King of juke box speakers. Shipping weight 14 lbs. Net Price \$16.95. Two for.....\$32.95

15 INCH "JUKE BOX" P.M. ONLY \$9.95

Model 15-KR—Pre-War or Post-War, you never bought a speaker like this for such a scoop price. Made by a nationally known builder of fine speakers. A full 15" 12 1/2 oz. Alnico V magnet speaker of juke box quality. Has standard 8 ohm voice coil. Will take up to 18 watts average or 25 watts peak. Here is a speaker that will bring out those low notes. Latest 1948 production; not line through-outs. Every speaker is guaranteed new and perfect. We may not be able to continue this offer for long, so place your order now. Stock No. 15-KK. INCLUDE POSTAGE. Wt. 10 lbs. A \$35.00 value for only.....\$9.95

12 INCH 50 WATT SUPER HEAVY DUTY P.M. \$14.95

Model A-50—12" 50 watt super heavy duty permanent magnet speaker. Has 1 1/2" 8 ohm treated voice coil and one piece molded cone. Heavy half inch machined nut, with bolt secured 2 1/2" Alnico V magnet. Frame is of heavy construction with metal pot cover. Finished in silver-grey enamel. This speaker is the best value possible today. Efficiency is two to three times that of ordinary speaker. Especially recommended for all public address systems and high quality home audio systems. Will handle 35 watts with ease and 50 watts peak or short lengths of time. Its retail value is \$30.00. But, by our large purchase, we are able to offer it to you for only \$14.95. Do not confuse this speaker with surplus merchandise. This is the latest production. Model A-50. Shipping weight 13 lbs. Net \$14.95. 2 for.....\$29.90

12" WIDE RANGE P.M. SPEAKER \$7.95

Wide range 6.8 oz. Alnico V PM speaker. Curvilinear molded cones with 1 1/2" 8-ohm voice coils. Offered in 6", 8" and 12-inch sizes. Response from 60 to 10,000 c.p.s. Top quality by a nationally known maker.

Model 6-L1—Wide range 6" speaker.....\$4.95  
Model 8-L1—Wide range 8" speaker.....\$5.95  
Model 12-L1—Wide range 12" speaker.....\$7.95



SMALL SPEAKERS, NEAR MANUFACTURER'S COST

3 1/2" 1 oz. magnet PM speaker.....\$0.99  
3" 1 oz. magnet PM speaker.....\$0.99  
4x6" 1 oz. magnet PM speaker.....\$1.29  
3" 1 oz. magnet PM speaker.....\$0.99  
These speakers are all late production. Made for us by one of America's biggest speaker manufacturers. Packed 30 to the case. Order case lots. Deduct 5c for each speaker ordered.

BIG BARGAINS IN 4 OHM AUTO SPEAKERS

4" 4 ohm field speaker.....\$1.49  
4" 4 ohm field speaker.....\$1.49  
4" 4 ohm field speaker, square.....\$1.49  
6 1/2" 4 ohm field speaker, round.....\$1.49  
7" 4 ohm square, Philco Motorola.....\$1.99  
4" 4 ohm field speaker.....\$1.99  
Made by Magnavox and Claudagraph.

SPECIAL AUTO SPEAKERS

5 1/2" 4 ohm auto speaker, made by Magnavox. Fits some Motorola sets. A real hot number. Special, only.....\$9c  
6x3" Magnavox 4 ohm heavy duty auto speaker. Original equipment for General Motors auto radios. Special.....\$1.95

5,000 4" AND 5" PM'S

5,000 4" and 5" PM's. 1 oz. Alnico V with mounting bracket. When McGee buys a bargain, so can you. Made by Permaflux. All brand new factory cartoned. Every speaker guaranteed perfect. Buy yourself a good supply at manufacturer's cost. Only 5,000 to sell, each.....\$0.89  
Buy 10 assorted speakers, 10 for.....\$8.90

SALE ON OUTPUTS

Regular Universal Output Transformers

2,000-14,000 ohms to voice coil.....\$1.19

4 watt, universal output.....\$0.79

8 watt, universal output.....\$0.99

12 watt, universal output.....\$1.19

Special Push-Pull Output Transformers

Small 1/2" push-pull, for 60L6.....\$0.9c

8 1/2" push-pull trans., for 6K6.....\$0.9c

8 1/2" push-pull trans., for 6V6.....\$0.9c

Small Equipment Output Transformers

2,000 ohm, for 50L6 output.....\$0.39

5,000 ohm, for 6V3 output.....\$0.39

10,000 ohm, for 3Q5 output.....\$0.39

Assortment of 10 of these trans.....\$3.50

Push-Pull 6L6 Output Transformers!!!!

Special chrome plated, fully shielded heavy output transformer, for push-pull 6L6's. Made for Scott. A real \$5.00 value. Your net price only.....\$2.95

CONSOLE BASS REFLEX SPEAKER Baffle \$19.95

6 Cubic Foot Utility Bass Reflex Speaker. Bass Reflex 32x22x10. Heavy construction with curved pleasing lines. Telotes lining assures non-rattle reproduction. Brown leatherette covered. Chrome front trim. Specify when ordering whether for use with a 12" or 15" speaker. Weight 40 lbs. This is an ideal baffle for our deluxe Coaxial model CR-13X, Bass Stock No. NA-12. Net \$19.95. 12" Coaxial PM Speaker and NA-12 Baffle both for \$29.95. You will be pleased with the fine tone of this combination.

PLASTIC GRILL SPEAKER Baffles



Just one type of speaker baffle, here in the prettiest line of speaker baffles you have ever seen. Tri-color curved plastic grills. Good plywood construction, with matched leatherette covered sides.

12 IN. WALL BAFFLE \$3.95

12" standard baffle with curved plastic grill. Stock No. 12-W: \$3.95. Buy 4 for only \$14.95.

8-10 IN. WALL BAFFLE \$2.95

8" or 10" Flat mounting wall baffle, with plastic grill. Will hold either 8" or 10" speaker. Stock No. 8W: Your cost, \$2.95 each; 4 for \$10.95.

12 IN. CORNER BAFFLE \$3.49

Unique design 12" corner mounting baffle. Mounts snugly into corner, giving best sound distribution. Plastic front. Stock No. 12-C: Your cost, \$3.49 each; 4 for \$12.95.

HIGH QUALITY P.M. For Use With Above Batteries

12" P.M. \$4.95

12 inch PM with 6.8 ohm Alnico V magnet. 8 ohm voice coil. This is the standard 12 inch PM of the sound industry. Ideal for juke boxes, PA systems and extension speakers. Stock No. CH-12, net \$4.95; three for \$13.95.

POWER TRANSFORMERS

60 MA. Fully Shielded Upright Mounting. 600 volt CT. 6.3 volt, 2 amp., 5 volt, 2 amp. Special.....\$1.95

100 MA. Fully Shielded Upright Mounting. 700 volt CT. 6.3 volt, 4 amp., 5 volt, 3 amp. Merit. Special.....\$2.95

150 MA. Fully Shielded Upright Mounting. 750 volt CT. 6.3 volt, 5 amp., 5 volt, 3 amp. Very Special Value.....\$3.95

200 MA. Fully Shielded, Flush Mounting. 800 volt, CT. 6.3 volt, 5 amp., 5 volt, 3 amp. Special.....\$3.95

50 Mill Flush Mounting. For small radios 6.3 volt and high voltage CT. Net.....\$1.95

SALE AC LINE CORDS For Radio Set Replacement

6 1/2 ft. G.E. plastic AC cord and cap.....\$1.9c

8 ft. G.E. plastic AC cord and cap.....\$2.2c

6 ft. rubber AC line cord, bakelite plug. Special sale price.....\$1.25

McGEE RADIO COMPANY

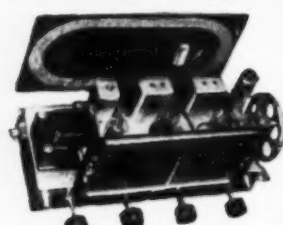
November, 1949

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TELEPHONE VICTOR 9045. WRITE FOR FLYER 1422 GRAND AVE., KANSAS CITY, MISSOURI



# HALLCRAFTERS S-59 8-TUBE FM-AM CHASSIS \$3295



S-59 8-TUBE FM-AM CHASSIS \$32.95

★ Regular \$50.00 Value ★ Push Pull Audio ★ Phone Input  
★ High Fidelity Response Go To 14,000 CPS

Model S-59 Hallcrafters, high fidelity, 8 tube FM/AM chassis, for custom installations. Receives broadcast 540 to 1700 KC and FM—88 to 108 Mc. Size 12½x7½x9". An excellently engineered chassis, with accurately calibrated slide rule dial, Variable tone control and 60 to 14,000 cps, wide range audio. (Push-pull 6B6) 8 ohm output transformer will match most PM speakers. No special output transformer required. Loop antenna built on, for broadcast reception. This is without a doubt the most radio chassis value we have ever been able to offer. Better rush your order in now. We have them. Heavy duty 6X9" PM speaker, for use with the blond console, pictured on the right, \$2.95 extra.

S-59 8 tube FM/AM chassis, with tubes, wt. 16 lbs. Net \$32.95

S-59 8 tube FM/AM chassis, with tubes and regular \$12.95 12" coaxial PM speaker, CH-13X. Wt. 24 lbs. Net \$42.95



CABINET FOR S-59 \$19.95

Beautiful blond console cabinet, Size 17 x 21 x 33" high. This cabinet was intended for use on a nationally known \$129.00 radio-phonograph combination. The lower half of the cabinet is divided for albums. The upper half has a hinged lid, which covers the radio and changer. Radio panel is 15" x 15", with a 6" x 6" speaker. Shipping wt. 40 lbs. Stock No. JB-4 blond cabinet, \$19.95. 6" x 9" 4.64 Alnico V PM speaker \$2.95 extra. Stock No. JB-5X same but blank radio panel. \$19.95. Stock No. B-1000 cabinet just as we brought this. Ten re-do the radio and changer area to suit your own need. Changer area is now 15 x 15" and radio area 5 x 15" 11½". Stock No. B-1000. Shipping wt. 40 lbs. \$14.95

## STUDENTS — EXPERIMENTERS — BUY YOUR KITS FROM MCGEE

6-TUBE AC 2 BAND RADIO KIT \$9.95

BIGGEST RADIO KIT VALUE IN U. S.  
BUILD A RADIO WITH MATCHED "DETROLA" PARTS



CHOICE OF EITHER 8 OR 10 INCH DYNAMIC SPEAKER \$1.99 EXTRA

A complete kit of parts, tubes and ready punched chassis to build a fine 6 tube power transformer type radio chassis. (No cabinet.) We furnish every piece as well as a printed diagram and photograph. Chassis size 14 x 7½ x 7. Receives standard broadcast and 6 to 18 MC foreign short wave. Gang tuning condenser used on both bands. 90 mil power transformer 6W6 output tube. This kit is made up of parts intended for use in a high quality Detrola radio. Has full lighted slide rule dial. Everything goes together just like a factory built radio. Priced complete with 6 tubes. Kit model 6-ACX. Less speaker \$9.95. Weight 16 lbs. Net \$9.95.

**18-WATT AMP KIT FOR INSTRUMENTS MIKES OR PICKUP \$14.95**  
General purpose portable amplifier kit, housed in an attractive portable case, with 10" speaker. Two inputs for instruments or mike. Variable tone control. Kit is complete with diagrams and photos. 2nd tubes: 2-12X7, 6X4, 2-6AQ5. AC transformer type. Stock No. MM-18RC, weight 20 lbs. Net \$14.95. Crystal mike and desk stand, \$4.95 extra.

**GAROD DELUXE 5-Tube Kit \$10.95**  
One of our latest and finest AC-DC radio kit. Receives Broadcast, 340 to 1650 KC. Has full length illuminated slide rule dial. Choice of Ivory or Walnut plastic cabinet. Full high efficiency 2 gang superhet circuit, with loop antenna. Ready punched chassis, full 5" PM speaker. Every part fits. Everything furnished, including 6 tubes, 2-12X7, 2-6AQ5, 50L6. This kit will go together just like it would on the production line. Diagram, photos and instructions are furnished. Shipping weight 9 lbs. Kit model XA-49. Net \$10.95.



MCGEE'S NEW FM-AM-PA KIT \$39.95

12 Tube Kit Model PRK-51. This is the most elaborate radio, P.A. kit that our engineering department could design. Here are its features: Receives broadcast, 340 to 1650 KC and FM, 88 to 108 mc (3 gang tuning on FM). The audio system is wide range, 40 to 17,000 cps. 5 lb. interwound high fidelity output transformer, 8 ohm speaker. Twin tone controls, bass and treble boost. Phonograph inputs for standard crystal or dynamic variable reluctance. Mike input for crystal or dynamic mike. This radio can be used for an 18 watt P.A. system, a recording amplifier, or for a high fidelity T.V. sound system. Chassis size 15½ x 7½ x 7. Comes with the kit, including tubes: 6AG5, 6SB7, 2-6BA6, 6AT6, 6H6, 6BE6, 2-12A7, 2-6X5, and 5Y3. The FM RF section is ready wired coils and sockets, to make this kit easier for you to build. 6" x 9" 4.64 Alnico V PM speaker, with photos and instructions, \$39.95. Speaker recommended, Oxford 12", 22 ohm, 15W, curved cone and 1½" voice coil. Model 12-XMS \$10.00 extra.

**ONLY \$9.95 BUYS A 6-TUBE RADIO KIT**  
6 tube superhet, broad cast AC-DC kit. Utilizes 12 tubes. Housed in a Farnsworth plastic cabinet, with slide rule dial, B.F. stage, 2 gang condenser, loop antenna and 5" speaker. This makes a factory like radio. The radio chassis is ready punched and sockets are installed. This type of kit usually sells for at least \$15.00. All parts furnished, including tubes: 12K8, 2-12SK7, 12N7, 35L6 and 35Z5. Complete with diagrams and photos. Kit model PS-6. Wt. 8 lbs. \$9.95.

**Garod Personal Portable Kit \$12.95 with Batteries**  
Complete Garod Personal Portable Radio Kit Model X-45. Made from genuine Garod factory matched parts. A complete kit to build a broadcast battery operated 4 tube receiver. Small in size 6½x3½x4½". Weight 3½ lbs. 2 Gang Superhet circuit set comes on when lid opens. Rugged metal case with colored plastic front and back. Loop antenna in lid. Furnished with diagram and photos, tubes and 67½ B-Battery. Will go together like a factory built radio. Shipping weight 6 lbs. \$X-45 \$12.95. Model X-45WT Portable Radio is X-45 wired ready to operate net \$14.95.

**PORTABLE RECORD PLAYER KIT \$9.95**  
Deluxe Portable Record Player Kit housed in the attractive Capital case. Includes all parts and easy to follow diagram. Has 4" Heavy Duty PM Speaker. 78 RPM Phono Motor. All necessary parts to build a 70L7 type Amplifier. Weight 14 lbs. Model CK-1. Net \$9.95.

**BUILD YOUR OWN AMPLIFIER**  
TM-12—12 WATT KIT \$10.95  
TM-20—20 WATT KIT \$15.95  
Kit Model TM-12. 12 Watt Amplifier Kit. Ideal for a high quality record player as a P.A. System or recording amplifier. Matched component parts ready punched chassis. One control fades from phone to mike. Input compensation for G.E. Variable Reluctance pick up. Output matches 8 ohm Voice Coil. 100 Mill Power Transformer. Complete with tubes, diagram and photos. 2-6V6, 2-12AX7, and rectifier. Variable tone control. Model TM-12. Weight 10 lbs. Net \$10.95. Crystal mike and desk stand \$4.95 extra. TM-12 custom wired and tested \$4.00 extra.

**Garod Personal Portable Kit \$12.95 with Batteries**  
Complete Garod Personal Portable Radio Kit Model X-45. Made from genuine Garod factory matched parts. A complete kit to build a broadcast battery operated 4 tube receiver. Small in size 6½x3½x4½". Weight 3½ lbs. 2 Gang Superhet circuit set comes on when lid opens. Rugged metal case with colored plastic front and back. Loop antenna in lid. Furnished with diagram and photos, tubes and 67½ B-Battery. Will go together like a factory built radio. Shipping weight 6 lbs. \$X-45 \$12.95. Model X-45WT Portable Radio is X-45 wired ready to operate net \$14.95.

**DETROLA—SCOOP COILS, GANG, DIAL, PAN \$2.95**  
Genuine Detrola Chassis pan with 6 oet sockets. Heavy glass slide rule dial. 3 Gang Tuning Condenser. All RF and IF coils and band switch for standard broadcast and foreign short wave. Buy these parts for less than the coil value alone. These parts will fit the chassis properly. Only material pictured and listed above is offered. It is not a complete kit. You supply your own tubes, speaker, resistors, capacitors, etc. Stock No. DET-1. Shipping weight 6 lbs. Net \$2.95.

**3-SPEED PLAYER KIT \$16.95**  
3 Speed Record Player Kit. Deluxe Capital portable case pictured above. All parts furnished to build a two tube 70L7 type amplifier (Tone and Volume Control). Alnico V PM Speaker. 35, 78 and 45 RPM Phono Motor. Easy to follow assembly instructions. Shipping weight 16 lbs. Stock No. 347-K. Net \$16.95.

**8-WATT AMPLIFIER KIT \$8.95**  
Kit Model TM-8. Similar in size and shape to Model TM-12. 8 Watt amplifier kit for utility use, record playing, or paging. Matched component parts. Ready punched chassis. Variable tone control. One Control fades from mike to phone. Input compensation for G.E. Variable Reluctance pick up. Output matches 8 ohm Voice Coil. 75 Mill Power Transformer. Price includes tubes, diagram and photo. Push pull 6AQ5, two 12AX7, plus rectifier. Kit Model TM-8. Weight 8 lbs. Net \$8.95. Crystal mike and utility desk stand \$4.95 extra. Model TM-8WT amplifier is TM-8 kit wired ready to operate, net \$11.95.

**Model 221-K Eico High precision vacuum Tube-Volt-Ohm Meter Kit.** All parts furnished. AC-DC. Ranges 0, 5, 10, 100, 500 and 1000 Volts, Ohms in 5 steps. 1000 Mc. Fundamentals to 34 M.C. A tremendous value. Shipping weight 12 lbs. Net \$23.95.

**BUILD THESE THREE TEST INSTRUMENTS AND HAVE THE BEST.**  
Model 400-K 5" Scope Kit. All parts and tubes furnished. Ready punched chassis and beautiful metal case. Sensitivity 3 Volts. Sweep 15 to 30 K.C. Tube component 2. 6J57, 2. 5Y3, 884 and 58P1. This Eico Scope Kit is the best. Shipping weight 10 lbs. Net \$39.95.

**ST. GEORGE WIRE RECORDING MECHANISM \$22.95**  
St. George wire recording mechanism. Brand new, complete with wire recording and playback mechanism. (Also plays 78 RPM records when crystal pick-up is installed.) Records and plays back up to 1 hour on standard Webster wire. Furnished with diagram for 3-tube converter (adapts radio or amplifier for wire recording). X-93 St. George mechanism, weight 15 lbs. Requires 6X13X3½" space. Net, \$22.95. Crystal pick-up for playing and recording. Phonograph records \$1.95 extra. Webster wire, 1 hour, \$3.25; 30 min., \$1.95; 15 min., \$1.30. Crystal mike and desk stand, \$4.95 extra.

**WIRE RECORDER CONVERTER \$12.95**  
With this 3-tube converter you can adapt the St. George Airing, or Webster Chicago wire recorder mechanism to any radio or P. A. system. Only 3 connections necessary. Just plug in to the phone input of your amplifier and connect to plate of output tube. AC-Transformer construction. Gain for mike, 3 position switch for quickly changing from record to play-back. Priced ready wired and tested with instructions and tube 12A7T pre-amplifier; 6AQ5 Oscillator; 6X4 rectifier. Stock No. RH-V, net, \$12.95.

**Model 320-K Eico Signal Generator Kit.** All parts, tubes and instructions furnished. 7 tubes per set. Sensitivity 3 D.C. volt ranges to 2500 volts. 4 A.C. voltage ranges to 1000 volts. When wired will make a tape recorder and playback amplifier of good quality. Inputs for crystal or dynamic mike and phone pick-up. May be connected to the detector of any radio set to record radio programs. Output transformer matches any 8 ohm speaker. Tone control. Complete with tubes: 6F5, 7F7, 7N7, 2-6V6, and 6X5. Shipping weight 20 lbs. Stock No. TPR-10. Net \$19.95.

**VOLT OHM METER KIT \$14.95**  
Electronic Instrument Volt Ohm-meter Kit. 3" meter, 1000 ohms per volt sensitivity. 3 D.C. volt ranges to 2500 volts. 4 A.C. voltage ranges to 1000 volts. When wired will make a tape recorder and playback amplifier of good quality. Inputs for crystal or dynamic mike and phone pick-up. May be connected to the detector of any radio set to record radio programs. Output transformer matches any 8 ohm speaker. Tone control. Complete with tubes: 6F5, 7F7, 7N7, 2-6V6, and 6X5. Shipping weight 20 lbs. Stock No. TPR-10. Net \$19.95.

**Build Your Own Radio Station**  
**Miniature Broadcast Station Kit \$6.95**  
Kit Model DE-6X. Build your own 110 Volt AC-DC 4 tube miniature radio station—(800 to 1500 KC) broadcast from crystal mike or phone record. Warning: this transmitter must be used with only a short aerial otherwise you will transmit 2 or 3 miles.) Complete kit including tubes, diagram and instructions. Weight 4 lbs. Net \$6.95. Model DE-6XWT. Miniature transmitter ready to operate \$8.95. Crystal mike and desk stand \$4.95 extra.

**WIDE RANGE AMP-KIT \$29.95**  
It's the newest thing in audio amplifiers. McGee's wide range, 34 watt amplifier kit with 6 outputs for crystal or dynamic mikes and any crystal phonograph cartridge, as well as the new G.E. variable reluctance cartridge. Output transformer is wax impregnated, weighs 6 lbs. Voice coil taps 4-8-15-250 and 500 ohms. Push-pull 6L6 output tubes. Separate electronic base and treble boost. Inverse feedback. Input tube filament is DC heated to reduce hum level to nil. Frequency response from 20 to 20,000 cps. Easy to follow diagram and photos for easy assembly of this kit. Ready punched chassis. Every part furnished, including tubes: 2-6L6, 5V4, 3-12AX7. Shipping weight 25 lbs. Stock No. XX-34. Net \$29.95.

**1 HOUR TAPE RECORDER MECHANISM \$59.95**  
**TAPE RECORDER 1 HOUR MECHANISM TWIN CHANNELS SPECIAL \$59.95**  
Our leader tape recorder mechanism—Size 10½x13½x7½-16, weight 16 lbs. Tape speed full 7½ feet per second—two-track. One hour with 7½ reel, 30 minutes with 5" reel. Bias frequency to erase 50K.C. Twin erase heads, one recording head. Response flat from 60 to 8,000 cps. Non-slip and Wow-less drive. Made for high fidelity recording and playback. Tape. Furnished complete with suggested diagram and erase coil. Model TPR-4 Tape recorder mechanism, as priced, \$59.95. Recording Tape 7" Reel. \$2.50.

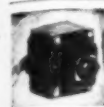
**McGEE RADIO COMPANY** PRICES F.O.B. K.C. Send 25¢ Deposit with order. Bal. Sent C.O.D. With parcel post orders include postage. **TELEPHONE VICTOR 9045. Write for Flyer 1422 GRAND AVE., KANSAS CITY, MISSOURI**

**RADIO & TELEVISION NEWS**



# DEALERS—BUY YOUR TELEVISION AND RADIO PARTS from McGEE

**Farnsworth Television Chassis Scoop.....\$5.95**  
Farnsworth Television Chassis Model GV260 partially built up Chassis Size 12 x 17. Has 16 Tube sockets and over 150 small parts (Resistor and Ceramic Condensers) no coils or tuning unit. Sweep and sync circuits are all partially wired up. This T.V. Chassis is ideal for the student and experimenter. Learn T.V. by building your own set using this chassis to start from. Furnished with a 1948 regular \$3.00 Supreme Publications Television Manual, which has a complete schematic of this chassis as well as 9 pages of service information. If you want to play with Television here is a chance to get started. Farnsworth GV260 partially built up Chassis and 48 Supreme T.V. Manual all for \$5.95. Include postage for 11 lbs. GV260 Chassis only..... \$2.95



## T.V. POWER TRANS. SCOOP PRICE \$2.95

Order This With Your Farnsworth T.V. Scoop Chassis

GV260 Power Transformer, C-94230Z, 135 Mil Tapped 110 Volt primary. Supplies plate voltage and filament for part of Farnsworth T.V. Chassis. 375 V.D.C. 6.3 and 5 filament. Shipping wt. 7 lbs. Scoop price \$2.95

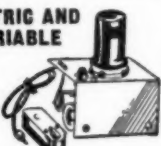
**FARNSWORTH T.V. CABINET \$9.95**  
This attractive cabinet built for the Farnsworth GV260 Chassis we offer above. All Mahogany Table Cabinet, for 10" size picture tube. Front Panel already cut. This we suggest you order with the above chassis. It is the correct cabinet and will make a nice looking T.V. set. Shipping weight 33 lbs. Stock No. RV-10. Net \$9.95.

## G.E. RPX010 V.N. GART. \$2.95

G.E. RPX010, with permanent needles. \$2.95. Reusable. \$2.49 extra. A lucky purchase by us enables this terrific General Electric cartridge value.

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## WIRE RECORDER and 18-WATT P.A. SYSTEM

SALE PRICE \$69.95

Three years of wire recording experience has led us to the development of this combination wire recorder and public address system. Housed in an attractive portable case with hinged lid on the recorder compartment. Beautiful streamlined plastic grill. Storage compartment in back panel for mike and accessories. Size 21x11x14. A full 18 watt HI F1 amplifier with P.P. 6V6 tubes in output stage and separate 6AQ5 eraser circuit. This new super erase circuit eliminates all the bugs in wire recording. 12-inch Alnico V. P.M. speaker. Extension speaker jack. Mike input, tone control. Equipped with General Electric wire recorder playback mechanism that has 74 rpm turntable and General Electric variable reluctance pickup. You can record or play phone records. Record from mike. The play-back quality is top. Plenty of volume and good fidelity. This is also a top wire recorder. Unit is completely assembled and ready to operate. Furnished with 15 minute spool of Webster recording wire. Extra recording wire, 15 min. \$1.30; 30 min. \$1.95; hour, \$2.25. Model GR-16 Portable public address system and wire recorder shipping weight 38 lbs. Net \$69.95. Crystal Mike and Desk Stand, \$4.95 extra.

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**BUICK VIBRATOR FITS ALL BUICK SETS FOR 11 YEARS 1937 THRU 1947**  
McGEE'S PRICE \$195  
10 FOR ONLY \$17.95

Here is the hottest vibrator Scoop in McGee's history. All new Delco Vibrators, not war surplus, but vibrators dumped by United Motors themselves. You save over half and still buy the best. This Delco Buick vibrator (replaces Mallory 271HD) fits all Buick original equipment sets from 1937 thru 1947. The regular dealers net on this vibrator is \$4.14. McGee's sale price only \$1.95. 10 for \$17.95. Standard 4-prong, 11 1/2" can, short enough for Chrysler, Plymouth sets. 8-point, heavy duty. Replaces Mallory 294. Regular dealers' net, \$2.62. McGee's price, \$1.29; 10 for \$11.90. Old 4-prong, 11 1/2" can, Delco 1301, replaces Mallory 852. Popular GM car sets. Regular \$2.46. McGee's price, \$1.49; 10 for \$12.95.

Chevrolet vibrator, Delco No. 8622, replaces Mallory 273D. Can size 2x4 1/2. A sync with buffers. Odd 5-prong. McGee's price, \$1.95. Delco No. 8611, replaces Mallory 245A. A standard 5-prong sync, no buffers. Can size 2x3 1/2. McGee's price, \$1.95. Delco 8612, replaces Mallory 271HD. Offers 5-prong sync, no buffers. Can size 1 1/2x3 1/4. McGee's price, \$1.49. Delco 8613, replaces Mallory 954. Standard 6-prong sync, no buffers. 1 1/2x3 1/4 can. McGee's price, \$1.49. Delco 8610, replaces Mallory 245, 11 1/2" 3 1/4 can, 5-prong sync, no buffers. McGee's price, \$1.49.

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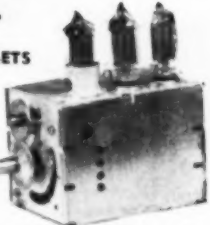
## McGEE RADIO COMPANY

November, 1949

## SARKES TARZIAN 12 CHANNEL TELEVISION FRONT END

THIS SAME TUNER USED ON 1949 MODEL T.V. SETS

SALE PRICE \$9.95 WITH DIAGRAM



SARKES-TARZIAN, 13 channel tuner for Television receiver. This 3 tube front end is all wired, including the detector. One same T.V. front end as used by several nationally known manufacturers. Built in fine frequency trimmer. Offered with printed schematic diagram. Priced complete with 3 tubes, 6C4 osc., 6AG5 mixer, and 6BH6 R. amplifier. This unit is worth twice our price. All wired, output is to be fed into your video channel. It can be mounted and used with the Farnsworth GV2-60 chassis, advertised to the left. Weight 2 lbs. Stock No. SK-T3. Net price, Sarkes-Tarzian, 13 channel tuner, \$9.95 with 3 tubes. Same as above only without fine frequency vernier drive. Type used in intercarrier circuits. Furnished with tubes and diagram. Stock No. IT-SK7. Net \$7.95.

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As usual, McGee offers you a better buy. We have on hand 100 DuMont 12QP4 Picture Tubes in original cartons, first quality, while they last only \$27.95. This is the best value in the U.S. today. 10BP4 10" Picture Tubes, manufacturer states, these tubes are well within tolerance but not quite high enough to beat brand name. McGee's tests fail to show any difference between this and any other 10BP4. Full factory guarantee. \$19.95

10BP4, net \$19.95. Sockets for either above tubes 49c each.

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MODEL	DESCRIPTION	NET
T110	Horizontal Deflection Output Transformer, Interchangeable with RCA Type 211T1 or 211T3	\$4.49
T117	Vertical Oscillator Transformer (Blocking), Interchangeable with RCA type 208T2	1.99
T122	Focus Coil, 247 Ohms D.C. Resistance, Interchangeable with RCA type 202D1	2.49
T121	Deflection Yoke, 8.3 MH. Vertical 50 MH. Interchangeable with RCA type 201D1	3.49
T116	Deflection Output Transformer, Interchangeable with RCA type 204T2	1.95

T.V. Power Transformer, similar to R.C.A. 290 Ma. 110 Volts, 60 Cycle, 760 Volts D.C. Filament 5 Volts at 3 amps, 5 Volts at 3 amps and 6.3 Volts at 3 amps. Shipping weight 39x41x51 1/2. Shipping weight \$6.95

T100	1st and 2nd Sound I.F. Transformers, Interchangeable with RCA type 208T1	\$1.29
T101	1st Pix I.F. Transformer, Interchangeable with RCA type 208T1	1.49
T102	2nd Pix I.F. Transformer, Interchangeable with RCA type 202K3	1.08
T103	Sound Discriminator Transformer, Interchangeable with RCA type 207K1	1.99
T104	Horizontal (Sync.) Discriminator Transformer, Interchangeable with RCA type 208T1	1.49
T105	3rd and 4th Pix. Coils, Interchangeable with RCA type 202L1	1.49
T106	Cathode Trap Coil, Interchangeable with RCA type 202K4	1.29
T107	Video Peaking Coil, 250 MH. Shunt Resistance 10 Megohms, Interchangeable with RCA type 203L2	.37
T108	Video Peaking Coil, 250 MH. Shunt Resistance 22,000 Ohms, Interchangeable with RCA type 203L2	.37
T109	Video Peaking Coil, 120 MH. Shunt Resistance 10 Megohms, Interchangeable with RCA type 203L3	.37
T110	Video Peaking Coil, 93 MH. Shunt Resistance 10 Megohms, Interchangeable with RCA type 203L4	.37
T111	Filament Chokes, .8 MH. Interchangeable with RCA type 204L1	.19
T112	Width Control Coil, Interchangeable with RCA type 201R1	.48
T113	Horizontal Linearity Control Coil, Interchangeable with RCA type 201R3	.48
T114	Audio Single Output Transformer (sneaker) for 6K6 Tubes	.60

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Complete 20 Tube T.V. set in an attractive mahogany cabinet. Complete with all tubes including Antastic 12L7, with telescopic V antenna. Made to retail originally for \$156.00. Stock TVS-5. McGee's sale price only \$99.50.

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Take 10% off on 10-lot assortment.

## \$15.00 LIST ELECTRIC CLOCK \$4.95

Elcra Self Starting Electric Clock, 6x5 1/2x2 1/4. Gold finish with plastic front. Weight 4 lbs. Stock # EX-1. Net..... \$4.95

## WARD T.V. ANT. \$6.49

Model TVH-9. Ward #250 list, all hand T.V. antenna. Model TVH-9 (Picture). Circular high and low band folded dipole with reflector. Furnished with mast as pictured. This is a terrific antenna buy. The regular dealers net was over \$15.00. Buy them now at McGee for only \$6.49. 10 for \$59.95.

## WARD TVA-94 \$2.49

Ward TVA-94, Folded dipole, with 5 ft. mast. Shipping less 300 ohm line. The regular net on this antenna is \$6.35. McGee's hot weather price..... \$2.49

**T.V. CHASSIS 30-TUBE, FOR 16" PICTURE TUBE BUILT FROM RCA PARTS \$159.95**

All RCA parts in this complete 16" Television Chassis for custom installations. Includes high and low band folded dipole with reflector. Has built-in voltage doubler for proper operation of 16" tube. This set is built 100% from RCA components and the famous RCA 630 Circuit. This is without a doubt the most television receiver you can buy. Offered at the low price of only \$159.95. 16" picture tube, 16CP4 \$59.95 extra. (16CP4 tube not sold separately. Stock # RCA-3016. Stock # RCA-3012. Exactly the same as the 16" job described above only for a 12" T.V. Picture Tube \$149.95. DuMont 12" Picture Tube \$27.95 extra.

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# The DOUBLE CHECKER

A versatile r.f. indicator which can be very useful around the ham shack.

By WALTER S. ROGERS, W1DPS

THERE are all sorts of handy and not-so-handy gadgets for checking neutralization and the presence of r.f. Some of these methods are safe, while many are very dangerous. The old wood pencil is a good example of the ill-advised methods, and the much-used neon bulb utilized as an indicator is another. Similarly, any absorption wavemeter can be lethal.

The need for a reliable, metered indicator for use around ham and experimental gear has brought about the creation of an r.f. indicator, called the Double Checker. A unit like this is simple to build.

For constructing a checker of this type, all that is needed is a sensitive meter, a pair of 1N34 germanium crystal rectifiers, a few feet of wire, and some sheet bakelite. The meter used should be a two-inch 0-1 milliamperere of the type that has been offered on the surplus markets, or these may be found among the "spare parts," with other meters. The one chosen for this unit was a radar manual range indicator, made by G-E, their Model AXE 221. Another type that should serve with equal success is the Weston two-inch 0-1 ma.

The completed circuit is shown in Fig. 3A. A variation can be made as shown in Fig. 3B, using a capacity "hat" rather than the inductance version. The latter L-C type is more sensitive and is just as easy to make.

The bat handle, as well as the dual-wound r.f. choke form, is cut out of 1/8-inch sheet bakelite, as shown in

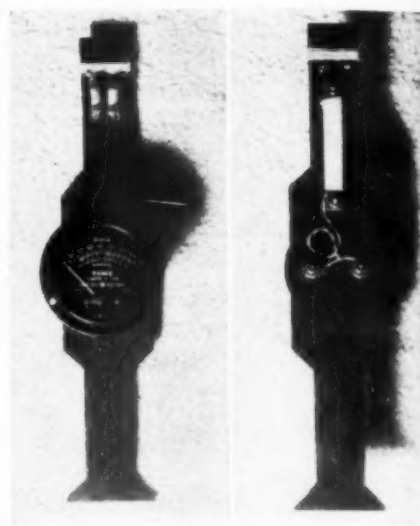


Fig. 1. Front and rear views of the completed versatile checker.

Fig. 2. Note that the holding notch is made so that the operator's hand is well away from the meter and the other parts of the circuit. Further guards may be added as extra precaution, but if care is exercised, no burns or shocks should be suffered.

After cutting and drilling the bakelite to make the necessary changes for the meter mounting holes, it is time to wind the pickup coil. Eight turns is about right, started approximately 1/2 inch from the top. Any wire (26 to 34 gauge), enamel, cotton, or silk covering, will do for this and the r.f.

Fig. 2. Detailed dimensional sketches of the bakelite handle (left) and the form for the r.f. choke illustrated at right.

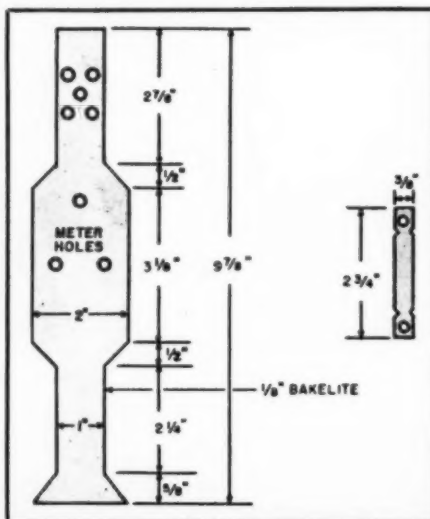
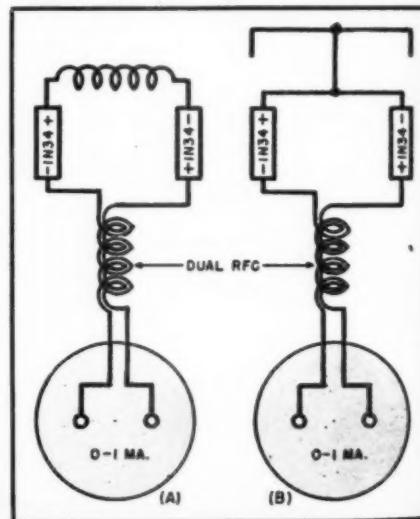


Fig. 3. (A) Circuit of the checker using inductive pickup loop. (B) Suggested circuit using a "capacity hat" pickup.





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- Size 9½"x6"x5", wt. 10 lbs.

EICO Model 221K VTVM kit.  
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805	3.63	6D6	.55
813	6.90	6K7GT	.54
815	1.37	6SH7	.27
843	.38	6SS7	.53
954	.18	7C4	.28
955	.18	12A6	.28
957	.18	12H6	.29
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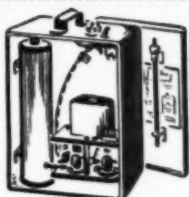
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Body: 2½" dia., 3½" depth behind panel. Bushing: ¾" dia., 3" long. Shaft: ¼" dia., 3½" long from bushing. Effective rotation 300 degrees. Mounts in ½" hole. 15 W. "PW" type wirewound on bakelite strip. 25 W. "SW" type wirewound on asbestos-covered steel strip, for greater heat dissipation. PW type has 3 terminals, no off position. SW type has 2 terminals with off position.



15W		25W	
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PW-150	150	SW-2	2
PW-200	200	SW-3	3
PW-250	250	SW-4	4
PW-300	300	SW-10	10
PW-400	400	SW-15	15
PW-500	500	SW-20	20
PW-600	600	SW-30	30
PW-1M	1000	SW-40	40
PW-2M	2000	SW-50	50
PW-3M	3000	SW-60	60
PW-5M	5000	SW-75	75
PW-7500	7500	SW-100	100
PW-10M	10,000	SW-150	150
PW-20M	20,000	SW-200	200
PW-50M	50,000	SW-250	250
		SW-300	300
		SW-400	400
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Stock No. PW 15 watt, ALL SIZES. **39c**  
List \$1.50. SPECIAL  
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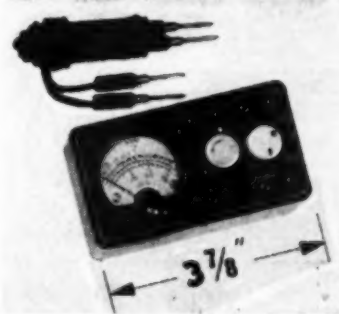
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L-554*	20	125 ma.	300	<b>4.95</b>
475-CH301*	3.8	75 ma.	100	<b>4.15</b>
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14010*	15	200 ma.	150	<b>2000V 5.25</b>
15406*	12	225 ma.	200	<b>5.25</b>
510-X2	15	200 ma.	145	<b>5.25</b>
S-16006	2.5-24	50/400 ma.	53	<b>10,000V 8.95</b>
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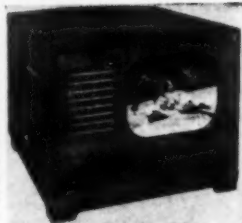


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## NOW 49<sup>95</sup>

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TELEKIT 10-B . . . \$69.95

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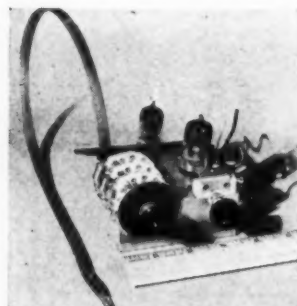
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TELEKIT BOOSTER . . . \$12.95

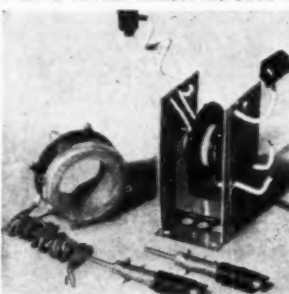
### 13 CHANNEL TUNER . . . \$12.95



13 channel front end is a compact unit with stage of R.F. for extra distance. Made to conform with Telekit or any other TV set having a video I.F. of 25.75 Mc. Complete with tubes, pre-wired, pre-assembled. Only 4 connections to make.

### CONVERSION KIT 16CK . . . \$12.95

Want a 16 inch picture? Here's all you need to convert any 10 inch TV set to 16 inch without increase in tubes. All genuine G. E. parts. Output transformer matches RCA or similar type yoke. Contains special 14 kilovolt output transformer, special focus coil, linearity coil, width coil, circuit diagram and instructions.



## TELEKIT

ELECTRO-TECHNICAL INDUSTRIES  
1432 NORTH BROAD STREET PHILADELPHIA 21 PA.

Write for catalog of Telekit antennas, boosters, television kits, tuners, television parts and tubes



### OIL CONDENSERS

most with ceramic pillar insulators.

Mfd	3000 vdcw	.....	\$0.75
.25	Mfd-3500 vdcw	.....	1.15
1.0	Mfd-500 vdcw	.....	.28
1.0	Mfd-600 vdcw	.....	.35
2.0	Mfd-400 vdcw	.....	.35
2.0	Mfd-600 vdcw	.....	.39
4.0	Mfd-500 vdcw	.....	.59
4.0	Mfd-600 vdcw	.....	.69
6.0	Mfd-400 vdcw	.....	.75
6.0	Mfd-600 vdcw	.....	.79
10.0	Mfd-600 vdcw	.....	.98
14.0	Mfd-600 vdcw	.....	1.75
15.0	Mfd-600 vdcw	.....	1.98
15.0	Mfd-1000 vdcw	.....	2.25
4-4-4	Mfd 400 vdcw 3 sec. 4 prong plugs in can 1 1/4" high x 3" Dia.	.....	\$1.49



### SELECTOR SWITCH

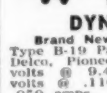
Poles	Pos.	Decks	Type	Price
1	12	1	Ceramic	\$0.55
1	21	3	Bakelite	.55
2	11	2	Bakelite	.60
4	11	4	Bakelite	1.17
6	11	6	Bakelite	1.68
18	5	9	Ceramic	1.90

### BARGAINS

(new surplus)



**REPRODUCER**  
Stromberg-Carlson 274494 RCA 22017-S 25W output waterproof, univ. match. transformer 50-12000 cps response. . . . \$14.95



**DYNAMOTORS**  
Brand New In Sealed Cartons Type B-19 Pack, Mark II. Mfd. by Helco, Pioneer, Wince. Input: 12 volts @ 9.4 amps. Output: 275 volts @ .110 amps; 500 volts @ .050 amps. Price . . . . \$4.95



**A REEL BUY!**  
50-ft. Antenna, flexible sturdy braided wire. Winds up into compact bakelite case only 2 1/4" x 2 1/4" x 1 1/4". Per foot for portable or fixed use. . . . \$1.49

**A. MOGULL CO., INC.**  
161 WASHINGTON ST., N. Y. C.  
Worth 4-0885



### POWER RHEOSTATS

ohms	watt	ea.	ohms	watt	ea.
5	50	\$1.24	375	150	\$2.74
5	150	2.74	400	25	.98
6	25	.98	500	25	.98
6	50	1.24	500	75	1.97
7	25	.98	585	150	2.74
7.5	100	2.25	750	25	.98
8	50	1.24	750	150	2.74
10	25	.98	1000	25	.98
12	25	.98	1200	225	3.25
15	25	.98	1250	50	1.24
16	50	1.24	1250	150	2.74
22	50	1.24	1500	50	1.24
25	25	.98	2000	25	.98
50	25	.98	2000	50	1.24
50	50	1.24	2500	100	2.25
60	25	.98	3000	25	.98
75	150	2.74	3000	100	2.25
80	50	1.24	3500	50	1.24
100	50	1.24	5000	25	.98
150	50	1.24	5000	50	1.24
200	25	.98	7500	50	1.24
250	25	.98	10000	100	2.25
350	25	.98	20000	150	2.74

Prices Net F.O.B. our Whse. N. Y. C.  
25% DEPOSIT-BALANCE C.O.D.  
Open acct. to rated firms.  
MINIMUM ORDER . . . . \$5.00

choke. The winding should be securely cemented in place (clear finger nail polish, or any coil dope will do).

While the cementing material is drying, it would be a good idea to wind the dual-wound r.f. choke, using #26 or 28 wire, enough to fill the choke form. This, too, should be properly doped. As the choke is not a critical part, it is believed no further instructions are necessary.

When both of the doped coils have properly dried and are no longer tacky, you are ready to assemble the unit. Bolt the dual-wound r.f. choke in place, solder the two 1N34 rectifiers, being sure that polarity is as indicated, and mount the meter using the terminal bolts for connections as well as mounting.

It is a good idea to check the polarity by bringing the pickup end near an oscillator so that the meter reads the proper direction. The leads at the meter may have to be reversed, and the finished Double Checker should look like Fig. 1.

This unit is excellent for neutralizing or checking r.f. strays, and even as a standing-wave ratio indicator. For this purpose, it is usually necessary to tape a small piece of bakelite or stick so that the pickup is just near enough to give a center of scale reading. By comparing the maximum to minimum, there is a good indication of standing-wave ratio.

The checker has been used with coax as well as other lines. As a modulation indicator, it is far superior to a neon, and if it is used with care, there will be more safety in the ham shack.

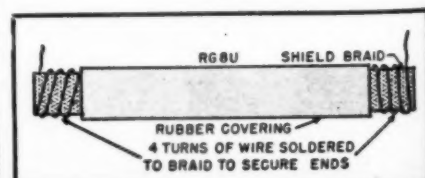
-30-

### SHIELDED TUBING

A VERY flexible, rubber covered, shielded tubing for general use in mobile installations, etc., can be made easily from RG-8U coaxial cable. All that is necessary is to cut the cable to the desired length, open the shield braid for about a half inch, and pull the polyethylene insulation and inner conductor through with a heavy pair of pliers. The polyethylene will slip out of the shielding very easily, and no difficulty should be experienced.

When the tubing is clear the ends should be finished to prevent the shielding from unraveling. With a razor blade cut the rubber insulation back for about a half-inch at both ends of the cable tubing and remove. Then take some stranded push-back wire, wrap about four turns around the exposed shielding, and solder it well (see Fig. 1). This will keep the end of the tubing clean and will also provide the ground lead for the cable. . . . M. K.

Fig. 1







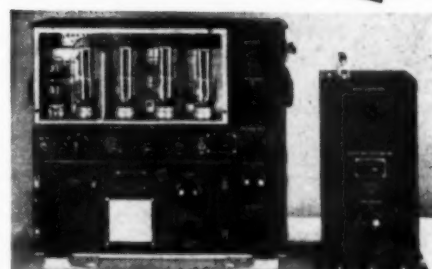
# Super Values

IN RADIO EQUIPMENT

## BRAND NEW GENERAL ELECTRIC 150-WATT TRANSMITTER

COST THE GOVERNMENT \$1800 EXPORT PACKED

The famous transmitter used in U.S. Army bombers and ground stations during the war. Design and construction have been proved in service under all kinds of conditions all over the world. The entire frequency range is covered by means of plug-in tuning units which are included. Each tuning unit has its own oscillator and power amplifier, coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle. Milliammeter, voltmeter, and RF ammeter are mounted on the front panel. Specifications: FREQUENCY: 200 to 500 KC and 1500 to 12,500 KC. Operates on 10 and 20 meter band with slight modification for which diagrams are furnished. OSCILLATOR: Self-excited, thermal compensated, and hand calibrated. POWER AMPLIFIER: Neutralized class "C" stage, using 211 tube and equipped with antenna coupling circuit which matches practically any length antenna. MODULATOR: Class "B"—uses two 211



tubes. POWER SUPPLY: Supplied complete with dynamotor which furnishes 1000V at 350 MA from either 12 or 24 volts. Complete instructions furnished to operate set from 110V AC. Shipping wt. 300 lbs., complete with all tubes including a full set of spares, dynamotor power supply, seven tuning units and antenna tuning unit.

## CLEARANCE BARGAINS

### MICROPHONES

Super Special—Highest quality all chrome bullet shaped CRYSTAL MIKE of top-flight nationally known brand

**\$5.95**

Dynamic MIKE \$7.95

APL MIKE \$3.95

T-32 MIKE \$2.95

MIKE Jr. 60c

PUSH-TO-TALK with switch on handle 95c

### AUDIO AMPLIFIER

Brand new, dual triode amplifier having 2 of the valuable and scarce 6AR5 type audio transformers that sell for \$12.50 apiece. Neat aluminum case, fully enclosed system—transformation 6 in. Perfect for intercom systems, phone amplifier for testing radio sets, signal tracer amplifier at only **\$3.40**. A sensational bargain at only **\$3.40** each.

### DELUXE RADIO KIT AC-DC

Extra high quality standard production line radio in kit form with complete instructions. Features 3 gang condenser, 2 iron core I.F. transformers, and polethylene insulated edge-wise wound antenna loop. Tubes include 12AT6, 12BA6, 12BE6, 50B5 & 35W4. Receives broadcast band from 550 to 1700 KC. Kit form **\$8.75** or 2 for **\$17.00**. Assembled, wired & tested **\$12.95** or 2 for **\$25.00**.

### ALL-PURPOSE NEON TESTER

60 to 550 volt. Indicate all kinds of current, AC, DC or RF, and comes complete with instruction booklet outlining the location of fuses, radio sets, including the location of fuses, dead stages, shorts, and making screen-grid and plate circuit tests. **35c ea.** Per doz. on attractive display card—**\$3.50**.

### UNIVERSAL 4 LEAD BROADCAST BAND OSCILLATOR COIL

can be converted to 3 lead type by addition of jumper. Ten for **\$1.00**.

### POWER RHEOSTATS

Exceptionally rugged. Trouble-free design. Withstand severe overloading to many times nominal 25 watt rating. 50, 60 and 200 ohms. 3 sizes available: **\$5.00**, **\$6.00** and **\$7.00**. Regular price **\$5.20**. Special—**\$1.00**.

### 11 TUBE SUPERHET RECEIVER

RT1055 is crystal controlled—covers the FM band. The ultra modern circuit uses the latest types of tubes including 7 miniature 6AJ5's. Beautiful chassis and aluminum cabinet. Tubes and diagram included. Only **\$14.95**.

### "DRILLMASTER" ELECTRIC DRILL

Ideal for hobbyists. Complete with sander, buffers, grinding wheels, etc. This is a bankrupt stock! Only a few available. A real bargain at **\$9.95**. Satisfaction guaranteed or money refunded if not returned prepaid within 5 days.

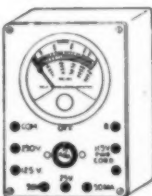
### HEAT GUN

streamlined pistol grip heat gun. Vivid glow of hot air. Cu. Ft. per min. of hot air at 100°F. Lifetime lubricated AC-DC motor of the rated vacuum cleaner type. Produces a hurricane of hot or cold air. Blow out dust from radio chassis. Dry out heat carburetors. Blow dry your wife's radiators or water pipes. Will dry your hair dryer or hair in half the time of ordinary hair dryer. Also good for drying stockings or clothing. Only **\$12.95**. Satisfaction guaranteed or money refunded if not returned prepaid within 5 days.

### AC-DC POCKET TESTER

#### SENSATIONAL VALUE

This analyzer, featuring a sensitive re pulsion type meter in a bakelite case is the peak of 15 years achievement in the instrument field by a large company specializing in electronic test equipment. Specifications of the AC-DC Model Volt-Ohm-Milliammeter: AC Volt—0-25, 50, 125, 250; DC Volts—0-25, 50, 125, 250; AC Milliamperes—0-50 DC Milliamperes—0-50; Ohms Full Scale—100,000; Ohms Center Scale—2400; Capacity—0.05 to 15 Mfd. Price prepaid anywhere in the U.S.A.—**\$7.00**. Similar DC Meter, lacking the AC operated ranges of above, **\$5.50** prepaid.



### CUT-RATE BUYS SIGNAL GENERATORS

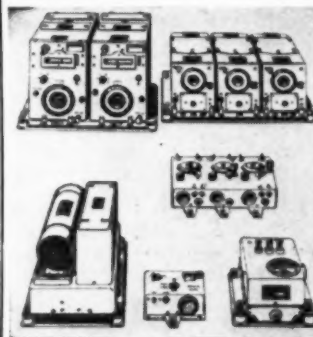
#### NEW 1950 KITS

New 1950 model 500 Signal Generator Kit. Modulation On-Off switch, internal modulation and external modulation jack provided. Internal 400 cycle saw-tooth audio available for external testing and fidelity checks on receivers. Precision coils for greater accuracy and maximum stability on all 5 bands. Dial calibrations from 150 KC to 104 MC. This signal generator is 115 V. A. C. 60 cycle operated and comes with everything, including complete detailed instructions. Assembling is an easy job, even for the least experienced. The lowest price and the best signal generator on the market for only **\$18.75**. Also available, factory assembled, only **\$28.75**.

#### TOP QUALITY—LOW PRICE

Genuine Laboratory-type precision signal generator. Manufactured and sold for \$68.00 in large quantities during the war by Northeastern Engineering Corp., one of the top manufacturers of electronic equipment for the U.S. Govt. 5 fundamental bands starting at 150 KC. Strong harmonics up to 120 MC. Five-step, ladder-type attenuator as well as potentiometer output control. Regular 1000 cycle audio oscillator using vacuum tube, not a cheap neon sawtooth audio oscillator. Audio output separately available externally. 16 lb. net weight shows the difference between this signal generator and the ordinary cheap oscillator used by average servicemen. Complete with fused plug and coaxial output lead. Super Special **\$38.75**.

### 274N COMMAND SET MADE BY WESTERN ELECTRIC



A mountain of valuable equipment that includes 3 separate Communications Receivers, covering up to 9.1 MC. 2 separate 40 watt Transmitters including crystals, 4-28v. Dynamotors (easily converted to 10v. A.C. operation), Preamplifier and Modulator, 2 Tuning Control Boxes, and 1 Antenna Coupling Box complete with R.F. Ammeter. 29 tubes supplied in all. Receivers and Transmitters instantly detached from mounting racks for use in separate locations. Removed from unused aircraft and in guaranteed electrical condition. A super value at **\$59.95** complete.

### PE-109 DC POWER PLANT

A gasoline engine coupled to a 2000 watt 32 volt DC generator. Can be adjusted to give 12 to 40v. output. Ideal for rural areas or to run any of the surplus items that require 24-32v. DC for operation. Tested and in good condition, only **\$79.95**. Converter that will supply 110v. AC from the above unit or from any 32v. DC source for **\$12.95**. We also have a limited supply of brand new PE-100A in original factory packing for **\$125.00** each. F.O.B. Buffalo.



### VOLT-OHM-CAPACITY METER VACUUM TUBE TYPE

There are more features engineered into this all purpose instrument than in any other instrument on the market regardless of price. Here are a few of its features:

- 3 inch easy to read meter.
- 6 DC voltage ranges from 0 to 1000v.
- Input resistance as high as 1 megohm per volt.
- 5 AC voltage ranges from 0 to 1000v.
- No dry disc rectifier to age and de-tune the accuracy of this VACUUM TUBE VOLT-METER.
- 6 Resistance ranges from 2/10 ohm to 1000 megohms.
- 4 Capacity ranges from .000025 to 20 MFD.
- A zero center range for balancing FM discriminators.
- Isolating resistor built into probe.
- Sturdy natural finish hard wood case.

This outstanding development of one of the leading manufacturers of test equipment costs only **\$39.50** complete with all leads, as illustrated.



### BIG SAVINGS ON TUBE TESTERS

#### SUPERTESTER

20,000 OHM PER VOLT SUPER-TESTER. Similar in appearance and made by same manufacturer as Vacuum Tube V-O Capacity Meter. Specifications as follows: DC volts at 20,000 ohms per volt: 0-3v, 15v, 60v, 300v, 1500v, 6000v. AC volts at 10,000 ohms per volt: 0-6v, 30v, 120v, 600v, 3000v, 6000v. Current: 0-60 Microamps, 0-6 MA, 60 MA, 600 MA, 6 Amperes. Resistance: 0-3000 ohms, 300,000 ohms, 3 Megs, 300 Megs. Decibels: Minus 4 to plus 77 DB divided into 6 ranges. All special 1% accurate multipliers used. No external source of power required for AC measurements although there is no frequency error in the range from 30 cycles to 1 megacycle. This SUPERTESTER has valuable features found in no other tester on the market, such as WIDEST resistance range coverage, HIGHEST AC voltage sensitivity, WIDEST power level (DB) coverage, and the lowest price—**\$29.95**. We urge comparison with these specifications before buying any tester.

#### 1950 MODEL

#### MUTUAL CONDUCTANCE

Attractive panel and case. Large 4 1/2" meter. . . . Calibrated microhm scale as well as Bad-Good scale. . . . Front panel fuse. . . . Individual sockets for all tube base types. Proper filament voltage supplied to test any tube ever made. Unequaled switching flexibility allows all present and future tubes to be tested regardless of location of elements on tube base. Indicates gas content. Detects shorts or opens in any element of any tube. Tests cold cathode, magic eye and voltage regulator tubes as well as all ballast, amplifier and rectifier types. Model "C"—Sloping front counter case—**\$59.95**. Model "B"—Handsome hand-rubbed portable case—**\$59.95**. Built-in roll chart with either model—**\$5.00** Extra.

Bayonet type radio pilot light sockets for model railroad enthusiasts, etc. **\$3.00** a hundred. Mazda licensed bulbs, per 10. **50c**.

**BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. RN11, BUFFALO 3, N. Y.**

November, 1949



(Continued from page 79)

**SWEEP-FREQUENCY GENERATORS**

Manufacturer	Type No.	Frequency Range	Sweeping Rate	Output	Output Impedance	Frequency Response	Distortion	Price	Special Features
Instrument Electronics	248	20-20,000 c.p.s.	2-20 per sec.	2 w.	600 $\Omega$	Flat	1%	\$550	a) can also be used as single-frequency B.F.O. b) contains logarithmic amp. for db. measurements.
Clough-Brengle	182-A	25-15,000 c.p.s.	5-6 per sec. 1 per 5-8 sec.	100 mw.	600 $\Omega$ 20k $\Omega$	Flat	5%	\$165	Can also be used as manual single-frequency, B.F.O.'s.
	282-A	Any 0-10 kc. band between 25-32,000 c.p.s.	2-10 per sec.	100 mw.	600 $\Omega$ bal. 4000 $\Omega$ unbal.	Flat	0.5%	\$425	
Clarkstan	125	40-10,000 c.p.s.	20 per sec.	50 mw.	500 $\Omega$	Flat	—	\$165	Uses photoelectric scanning of rotating disc.

**SINE-WAVE GENERATORS WITH WIDER RANGE THAN NECESSARY FOR AUDIO ALONE**

Manufacturer	Type number	Class	Frequency Range	Output		Output Impedance	Distortion	Accuracy of Calibration	Frequency Drift	Output variation	Hum and noise level	Price
				Matched load	Open-circuit Volts							
General Radio	700-A	B.F.O.	50 c.p.s.-5 mc.	150 mw.	10-15	1500 $\Omega$ unbal.	3%	$\pm(2\%+5\text{c.p.s.})$	—	(Note 1)	1%	\$700
Hewlett-Packard	650-A	R-C	10 c.p.s.-10 mc.	15 mw.	6	600 $\Omega$	1%	—	$\pm 2\%$	(Note 1)	0.5%	\$475
Boonton	140-A	B.F.O.	20 c.p.s.-5 mc.	1 watt	32	20-1000 $\Omega$	2%	$\pm(2\%+2\text{c.p.s.})$	2%+5 c.p.s.	(Note 1)	1%	\$1050
Supreme	666	B.F.O.	15-15,000 c.p.s. 65 kc.-60 mc.	150 mw.	35	50/500/5k $\Omega$ bal. 50k $\Omega$ unbal.	5%	—	—	$\pm 1$ db.	—	\$141.60
Hickok	288-X	B.F.O.	0-15,000 c.p.s. 100 kc.-160 mc.	—	—	—	—	—	—	(Note 1)	—	\$282

Note: (1) Contains vacuum-tube voltmeter to read output voltage.

**LOW LEVEL VACUUM-TUBE VOLTMETERS**

Type	Manufacturer	Model Number	Voltage Range (full-scale)	Scale Calibration	Frequency Range	Accuracy	Input Impedance	Price
R.M.S. or Average Value Meters	Ballantine	300(1)	0.01-100	Logarithmic	10-150,000 c.p.s.	3%	0.5 meg., 30 $\mu\text{fd.}$	\$200
		302(1,2)						
		304(1,3)	0.01-1.0	Logarithmic	30 c.p.s.-5.5 mc.	3% to 5%	1 meg., 9 $\mu\text{fd.}$	\$225
	Hewlett-Packard	400-A	0.03-300	Linear	10 c.p.s.-1 mc.	3%	1 meg., 16 $\mu\text{fd.}$	\$185
		400-B	0.03-300	Linear	2 c.p.s.-100 kc.	3%	10 meg.	\$195
		400-C(1)	0.001-300	Linear	20 c.p.s.-2 mc.	3%	10 meg.	\$200
		404-A(2)	0.003-300	Linear	2-50,000 c.p.s.	3%	10 meg.	\$185
	RCA	WV-73-A	0.01-1000	Logarithmic	20-20,000 c.p.s.	5%	1 meg., 25 $\mu\text{fd.}$	\$149.50
	Instrument Electronics	45(1)	0.005-500	Logarithmic	5 c.p.s.-1.6 mc.	3%	2 meg., 15 $\mu\text{fd.}$	\$210
		45-B(1)	0.005-500	Logarithmic	5-250,000 c.p.s.	3%	2 meg., 15 $\mu\text{fd.}$	\$200
		47(1)	0.0005-500	Logarithmic	15-20,000 c.p.s.	2%	1 meg., 18 $\mu\text{fd.}$	\$220
		47-B(1)	0.0005-500	Logarithmic	15-20,000 c.p.s.	—	50 meg.	\$235
	General Radio	727-A(2)	0.3-300	Linear	20 c.p.s.-100 mc.	3%	3-5 meg., 16 $\mu\text{fd.}$	\$180
	Furzehill	378-B/2(1)	0.01-100	Logarithmic	10-500,000 c.p.s.	5%	2 meg.	\$522
Peak-reading Meters	Ballantine	305(1)	Peak-to-peak 0.01-1000	Logarithmic	10-100,000 c.p.s.	2%	2.2 meg., 15 $\mu\text{fd.}$	\$280
	Measurements	67(1)	Peak-to-peak 0.03-300	Semi-log	5-100,000 c.p.s.	2%	1 meg., 30 $\mu\text{fd.}$	\$235

Notes: (1) Can also be used as voltage amplifier. (2) Battery-operated. (3) Range can be extended to 100 v. by multipliers.

(Continued on page 108)



SAVE MONEY  
SAVE TIME  
WITH KAYLINE

# SALE!

Here Are Great Buys for the Amateur and Serviceman, Industry and Laboratory in Standard and War Surplus.

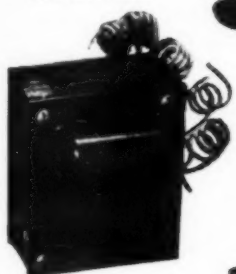


## Westinghouse Step-down TRANSFORMER

Cat. #2F20, Frame 406  
V.A. 25. Input 230 V.  
Output 115 V. \$2.95  
50-133 Cye. . .

## Dual Filament Transformer

Mfr. by S.N.C., Type 4P239, Pri. 120 V. 60 cye. Sec. 2-5V. @ 3.25 A. . . \$1.25



## POWER TRANSFORMER

Mfr. S.N.C., Type SP192 90 MA with leads. 350-0-350 V. 5V-3A. 6.3 VCT. 4A . . . \$3.25

## Allen-Bradley CONTACTOR

Bul. 700 Type B400  
110 V. 60 cye. Max.  
Rating: 10 amp 600 V.A.C.  
4 contacts. . . \$2.50



## DYNAMOTOR MODEL 5051

DC input volts 27.0 amps 1.50.  
DC output volts 28.5 amps .060. . . 75c



## I.F.

## TRANSFORMER

10.7 MC Band width  
50 KC. Band width  
loaded 80 KC. Stagger  
tuning 150 KC. Good for  
standard F. M. Tem-  
perature compensated.  
(Part of  
SCR-522A) . . . 49c

## BRAND NEW TUBES

1N24 . . . \$1.95	371B . . . \$2.95	807 . . . \$0.95
2C34 . . . .70	446A/2C40. . .70	822A . . . 2.45
2E22 . . . 1.39	446B/2C40. . .70	826 . . . 1.00
2C26 . . . .55	417A . . . 4.95	954 . . . .65
2X2 879 . . .75	715B . . . 9.95	957 . . . .65
3A4 . . . .49	723AB . . . 7.95	991 . . . .50
3P21 . . . 1.25	724B . . . .85	958A . . . .65
3P23 . . . 1.75	#14 Pilot bulbs—6 to 8	
5R4GV . . 1.29	volts . . . .10 for 40c	
5U4G . . . .60		
6AC7 . . . 1.00	1N34 . . . \$0.99	9006 . . . \$0.80
6AG7 . . . 1.00	1665/2050 . . .90	CNU7193 . . .49
6L6GA . . .95	8011 . . . 4.95	EL148 . . . .40
7C4/1206A. .35	8014A . . . 4.95	HY615 . . . 1.25
12A6 . . . .45	9001 . . . .80	VT138 1629. .50
12SH7 . . .69	9002 . . . .80	EF50 (Brit. . .
211 . . . 1.15	9003 . . . .80	1-h) . . . .49

## 4 GANG VAR. COND.



11-200 MMF. Each  
section counterbal-  
anced. Weight ap-  
prox. 3 lbs. 7 1/4"  
long. 3 1/4" wide,  
2 1/4" high. Mounts  
any position.

Brand New  
\$1.00

## 1" MIDGET METER

In all aluminum case. 0-1MA. . . \$3.95

## Westinghouse INERTEN CAPACITORS

15MFD 5000 V.D.C. Style 1363490C. 1.3 gal. nonflam.  
10d. 4 MFD 7500 V.D.C. Style 1363494. 1.3 gal. nonflam.  
10d. Write for prices.  
SOLDER 5 lb. spools, rosin core 38-62. . . \$3.75

## WAVEMETER



Here's an amazing value on Wave-  
meters which tune from 150-210  
mc and contain high quality reson-  
ant cavity wavemeter oscillator  
heterodyne amplifier electric tun-  
ing eye complete with 19 tub-  
es. 110 v. AC power supply. The  
tubes alone far exceed \$9.95  
the entire price of only

## TRANSMITTER

Range 150-200 Mc

BC-1072A — An outstanding  
Kayline value . . . \$19.95



## SYNCHRO-GENERATORS

For immediate deliv-  
ery. Types: 5F, 5G,  
5HCT, 6G, 6SG, 6DG.

Write for Prices



## Westinghouse Type SG RELAY

Style #155694, 230  
V. 50/60 cye. Size:  
5 1/4 x 3 3/4 x 5".



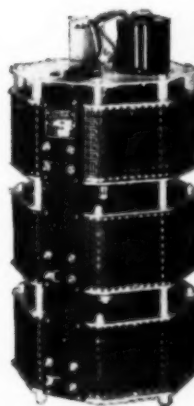
## POWERSTATS

Variable  
Autotransformer  
Mfr.  
Superior Elec. Co.  
Type MX-1156L-3Y  
Pri. V. 230 50/60 Cye.  
Output Volt Range  
0-230 V.  
Max. output  
17.9 K.V.A.  
Max. output 45 amps.  
Travel time 19 secs.  
Motor Driven

Type 1126-3Y  
Pri. V. 230 3 Phase  
60cye.  
Output volt range  
0-270  
Max. output 7.0  
K.V.A. 15 amps.  
Manually operated.

Type MX1226  
Pri. V. 230/115. 50/60cye.  
Output volt range 0-270V  
Max. output 2.4 K.V.A.  
Max. output 9 amps.  
Travel time 19 secs.  
Motor driven

Write for Quotations



TERMS: All shipments F.O.B. Baltimore, Md. Please  
send 20% deposit on all orders, balance C.O.D.  
Minimum \$2.00. CABLE ADDRESS: KAYD15CO.  
Unless otherwise stated, all items are sold as is.  
Unless otherwise specified,  
shipments made Rail-  
way Express collect.

## KAYLINE SERVES INDUSTRY & RESEARCH LABORATORY

## WESTINGHOUSE METERS

Meter: DC Ammeter  
Rating: 0-3 amps.,  
Type KX-24  
Ins. Rating: 750 V.  
Black dial  
Size: 4 1/4 x 4 1/4 x 1 1/4"  
Same as above with  
ratings: 0-1 Amps.  
0-6 Amps.  
0-25 Amps.



## AC VOLTMETER

Rating: 0-600 Volts AC  
Type: KX-24 Ins. Ratg. 750V.  
Size: 4 1/4 x 4 1/4 x 7". Black Dial  
Same as above with Rating 0-600DC V.  
Size: 4 1/4 x 4 1/4 x 4 1/4"  
Same with rating 0-1000 V. R-F. Black Dial  
Same with rating 0-300 V. AC  
Size: 4 1/4 x 4 1/4 x 7". Black Dial

## WESTINGHOUSE

Meter: DC Milliamp-  
eres  
Rating: 0-15 MA  
Type: KX  
Size: 4x4 1/4 x 5"  
Meter: Filament Meter  
AC

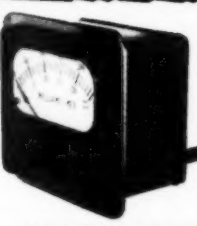


Rating: 0-10 V.  
Type: KA  
Style: 1058799-A  
Size: 4x4 1/4 x 5"  
Meter: Line Voltage Preset AC  
Rating: 0-6 scale, 15-150 cye. 125 V-250  
V. Type: KA  
Style: 1058825-A. With external resistor  
(10720 ohms) Meter  
Size: 4x4 1/4 x 5"  
Meter: Line Voltage Selector  
Rating: 0-300 V. Type: KA  
Style: 1058824-A  
Ins. Rating: 750 V. Size: 4x4 1/4 x 5"  
With external resistor (11,000 ohms)

## WESTINGHOUSE

Meter: Filament AC  
Rating: 0-10 V.  
Type QA-37  
Style: 1055633  
Size: 4 1/4 x 4 x 2 1/4"

Meter: Milliampers DC  
Rating: Two scale 0-20 & 0-200  
Type: QX-37. Style: 1058780-A  
Size: 4 1/4 x 4 x 2 1/4"  
Meter: Line Voltmeter AC  
Rating: 0-6 scale line volts, 125-250 V. AC  
Type: QA-37  
Style: 1055632. Size 4 1/4 x 4 x 2 1/4"



## WESTINGHOUSE



Same with Rtg: 0-150 MA. Style: 1203603  
Same with Rtg: 0-25 MA. Style: 1203596  
Same with Rtg: 0-1 volts DC. Scaled 0-100  
Same with Rtg: 0-300 V. AC (25-125cye.  
FS-5MA). Type: RA33. Style: 1204030  
Same with Rtg: 0-10 V. AC (25-125cye.  
FS-100 MA). Type: RA33. Style: 1204022

Meter: Milliampers  
DC  
Rating: 0-250 MA  
Type: RX-33  
Style: 1203605  
Size: 2 1/4 x 2 1/4 x  
1 3/4"  
Same with Rating:  
0-500 MA  
Style: 1203608

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COMPANY  
PHONE  
WILKINS 6464  
1803 N. LONGWOOD STREET  
BALTIMORE 16, MARYLAND

WRITE for Detailed Information and Prices



(Continued from page 106)

**DISTORTION AND NOISE METERS**

Manufacturer	Type number	Frequency range	Input level range	Range of distortion meas. (full-scale)	V.T.V.M. range	Noise measurement	Input impedance	Accuracy	Price
General Radio	1932-A	50-15,000 c.p.s.	0.8-30 v.	0.3%-30%	—	-80 db.	100k $\Omega$ unbal. 600 $\Omega$ bridging	$\pm 5\%$	\$575
Hewlett-Packard	320-A	400 c.p.s.; 5 kc.	70 db. attenuator	as low as 0.3%	no v.t.v.m.	—	20k $\Omega$ unbal.	—	\$75
	320-B	50; 100; 400 c.p.s. 1; 5; 7.5 kc.	70 db. attenuator	as low as 0.3%	no v.t.v.m.	—	20k $\Omega$ unbal.	—	\$150
	325-B	30; 50; 100; 400; 1000 c.p.s. 5; 7.5; 10; 15 kc.	—	as low as 0.3%	0.03-300 v.	-80 db.	20k $\Omega$ , 40 $\mu$ fd.	$\pm 3\%$	\$350
	330B, 330C	20-20,000 c.p.s.	—	as low as 0.3%	0.03-300 v.	-80 db.	20k $\Omega$ , 40 $\mu$ fd.	$\pm 3\%$	\$425
General Electric	YDA-1	50-15,000 c.p.s.	0.8-30 v.	1%-100%	1 mv.-1.0 v.	-80 db.	100k $\Omega$ unbal. 600 $\Omega$ bal.	5%	\$495
Barker & Williamson	400	50-15,000 c.p.s.	over 0.3 v.	—	3 mv.-0.3 v.	—	—	$\pm 10\%$	\$140
Doolittle	CHX-2	150-15,000 c.p.s.	over 1.0 v.	10%-100%	—	—	500k $\Omega$ unbal.	5%	\$250
RCA	69-C	30-15,000 c.p.s.	0.12-80 v.	0.3%-100%	—	-85 db.	20k $\Omega$ /200 k $\Omega$	—	\$593.75

**TRANSMISSION MEASURING EQUIPMENT**

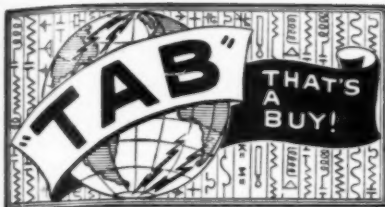
Type of unit	Manufacturer	Type number	Frequency range	Generator/attenuator section			Load and measurement section		Price
				Output levels	Attenuation range	Output impedance	Input impedance	Level ranges	
Attenuator and measurement set	Daven	10-A	30-17,000 c.p.s.	—	111 db.	30/150/250/600 ohms	4/8/16/150/250/600 ohms	+ 4 to +42 dbm.	\$550
		11-A	20-20,000 c.p.s.	—	114 db.	30/150/250/600 ohms	4/8/16/150/250/600 ohms	+ 4 to +42 dbm.	\$325
	RCA	89C	—	—	75 db.	600 ohms	30/250/600 ohms	0 to +22 dbm.	\$312.60
	Cinema Eng.	6343	20-20,000 c.p.s.	—	100 db.	5/30/150/250/500/600 ohms	15/30/150/250/600 ohms	+ 4 to +42 dbm.	\$550
Signal generator and measurement set	Hewlett-Packard	205-AG	20-20,000 c.p.s.	up to 5 watts	110 db.	50/200/600/5000 ohms	—	- 5 to +48 db.	\$425
	RCA	170-A	20-10,000 c.p.s.	up to 1 watt	—	10/250/500 ohms	250 ohms and high	5 v.-1000 v.	—
	Shallcross	692-A	1000 c.p.s.	—	53 db.	600 ohms	600 ohms	0 to +40 db.	\$125

**WAVE ANALYZERS AND AUTOMATIC FREQUENCY ANALYZERS**

Type of unit	Manufacturer	Type number	Frequency range	Input range (full-scale def.)	Selectivity	Input impedance	Voltage accuracy	Price
Wave analyzer	General Radio	736-A	20-16,000 c.p.s.	300 $\mu$ v.-300 v.	4 cycle bandwidth	100k $\Omega$ /1 meg.	$\pm 5\%$	\$920
		760-A	25- 7500 c.p.s.	1 mv.-10 v.	1% of tuned freq.	20,000 $\Omega$	—	\$400
	Hewlett-Packard	300-A	30-16,000 c.p.s.	1 mv.-500 v.	Adjustable 30 c.p.s.-145 c.p.s.	200,000 $\Omega$	$\pm 5\%$	\$625
	Western Electric	3-A	2-15,000 c.p.s.	—	Interchangeable 2 c.p.s.-200 c.p.s.	30 $\Omega$ and higher	—	—
	Electrodyn	4801	Speech freq.	—	12 simultaneous freqs. from 200-3500 c.p.s. 150 c.p.s. half-band	High impedance	—	—
Automatic spectrum analyzers	Panoramic	AP-1	40-20,000 c.p.s.	500 $\mu$ v.-500 v.	Variable	250,000 $\Omega$	$\pm 10\%$	\$1500
	Kay Electric Co.	Sona-graph	85- 8000 c.p.s.	—	—	—	—	\$1795
		Sonalator	Any 4000 c.p.s. band	—	—	—	—	\$1150 1400

(Continued on page 110)





### PRECISION RESISTORS

OVER 2 1/2 MILLION  
Specialists in Precision Resistors—We Ship Types  
in Stock—Accuracy Up to 0.1 Percent

0.116	125	550	1670	2635	8500	25833
0.42	135	575	1680	2700	8500	26000
0.42	140	580	1710	2750	8770	26500
0.607	147.5	588	1712	2850	9000	26600
0.7	150	600	1740	2900	9200	27000
0.7	160	612	1770	2870	9445	27500
1.3	165	625	1800	2900	9500	28000
1.75	170	633	1818	3000	9700	28400
1.75	175	640	1830	3100	9800	28800
3.3	179	641	1865	3163	9900	29000
3.3	182	645	1892	3200	10000	29500
3.3	184.2	649	1894	3290	10000	29900
4	200	650	1935	3300	10430	30000
4	209.4	657	1896	3333	10500	31000
216	216	665	1897	3384	10600	31500
3.025	220	670	1898	3500	10900	32000
3.025	220.4	673	1899	3509	10936	33000
6.25	225	675	1900	3700	11000	35000
7	230	680	1901	3730	11400	37000
7	235	681	1902	3760	11500	38140
7	240	684	1903	4000	11600	38500
8	245	689	1904	4030	12000	39000
10.38	245.4	697	1905	4200	12500	39500
11.25	250	699	1910	4250	12600	40000
12	260	700	1907	4280	13000	42000
13.52	271	711	1908	4500	13100	43000
14.2	275	723	1909	4514	13500	45000
14.25	280	740	1910	4440	13550	47000
14.5	286	750	1911	4444	13600	47500
15	290	800	1912	4500	14000	48000
16	299	800	1913	4720	14250	48600
17	300	850	1914	4750	14400	49000
17	310	854	1915	4850	15000	50000
20	311.5	899	1916	4885	14550	52000
22	320	900	1917	4900	14600	53000
22	325	910	1918	5000	15000	54000
25	330	917	1919	5100	16000	57065
26	340	946	1920	5210	16500	58335
26	345	978	1922	5235	16800	60000
30	360	1000	1924	5270	17000	61430
31.5	366.6	1030	1926	5300	17500	62000
37	370	1056	1960	5300	17977	64000
48	375	1067	1980	5600	18000	65000
48	380	1100	2000	5730	18300	66600
50	389	1110	2045	5770	18300	66650
51.78	390	1150	2080	5910	18500	67500
55	400	1155	2095	6000	18800	68000
56.7	410	1162	2100	6000	19000	68500
60	414.3	1175	2142	6125	19500	72000
63	418.8	1200	2145	6140	20000	73500
68	425	1225	2160	6300	21000	76000
74	426.9	1250	2160	6300	20500	81000
75	427	1260	2180	6495	21000	82000
80	440	1300	2200	6500	21500	83000
81.4	450	1322	2195	6840	22000	84000
88	452	1350	2200	6900	22500	85750
89.8	460	1355	2200	6900	22800	86000
90	470	1400	2500	7320	23000	90000
95	475	1488	2400	7500	23150	91000
100	478	1500	2450	7700	23525	93000
101	480	1500	2450	7950	24000	95000
105	487	1510	2483	7900	23500	
105.7	500	1518	2490	7930	24000	
107	518	1600	2525	8000	25000	
120	520	1640	2525	8000	25000	
121.2	525	1646	2600	8094	25200	
	540	1650	2625	8250	25400	

Any Size Above, Each	25c	Ten for	\$1.98	
100000	175000	245000	380000	620000
110000	180000	250000	400000	650000
130000	185000	260000	420000	660000
140000	186000	270000	420000	690000
150000	190000	275000	430000	700000
160000	190000	280000	440000	710000
170000	190000	285000	450000	716000
180000	190000	290000	450000	750000
190000	200000	300000	450000	750000
200000	200000	300000	470000	750000
210000	200000	310000	470000	800000
220000	210000	314000	500000	810000
230000	210000	318000	500000	830000
240000	220000	325000	521000	900000
250000	225000	330000	525000	930000
260000	230000	335000	540000	950000
270000	235000	350000	550000	
280000	238000	350000	570000	
290000	240000	375000	600000	

Any Size Above, Each	35c.	Ten for	\$3.50			
MEGS	1.5	2.11	3.3	4.7	7.5	11.55
1	1.57	2.2	3.5	5	7.62	12
1.1	1.579	2.25	3.673	5.5	7.74	12.83
1.2	1.6	2.5	3.75	6	8	13
1.25	1.65	2.7	3.9	6.3	8.02	13.85
1.3	1.75	2.75	4	6.5	8.15	15
1.4	1.8	2.8	4.23	6.6	8.25	20
1.4	1.9	2.855	4.25	6.7	8.5	
2	2	3	4.5	7	9	
Any Size Above, Each	70c.	Ten for	\$5.00			



(Continued from page 108)

### INTERMEDIATE LEVEL VACUUM-TUBE VOLTMETERS

Manufacturer	Model Number	Voltage Range (Full-scale)	Scale Calibration	Frequency Range	Accuracy	Input Impedance	Price
Measurements Corp.	62	1.0-100	Linear	30 c.p.s.-150 mc.	2%	2 meg., 7 $\mu$ fd.	\$135
General Radio	1800-A	0.5-150	Linear	20 c.p.s.-500 mc.	2%	25 meg., 3.1 $\mu$ fd.	\$345
Furzehill	281	1.5-150	Linear	50 c.p.s.-250 mc.	2%	4 meg., 9 $\mu$ fd.	\$360
Barber	VM-27	1.0-100	Linear	50 c.p.s.-50 mc.	2%	4 meg., 5 $\mu$ fd.	\$150
	LKV-300	3-300	Linear	20 c.p.s.-300 mc.	3%	3.5 meg., 4 $\mu$ fd.	\$60

### INTERMODULATION ANALYZERS

Manufacturer	Type number	Signal generator section				Analyzer section				Price
		Low freq.	High freq.	Output level	Output impedance	Input impedance	Required input volts	Ranges (full-scale defl.)	Accuracy	
Pickering	502	100 c.p.s.	4000 c.p.s.	-10 vu. to -100 vu.	30/210/600 $\Omega$	1.2 meg.	1.0 volt	5%; 15%; 50%	—	\$550
Western Electric	RA-1257 RA-1258	40; 60; 100; or 150 c.p.s.	1k; 2k; 7k; or 12k c.p.s.	+23 to -105 dbm.	600 $\Omega$	600 $\Omega$ or 1 meg.	-30 to +30 dbm.	5%; 15%; 50%; 100%	$\pm$ 5%	—
Altec-Lansing	—	40; 60; or 100 c.p.s.	2k; 7k; or 12k c.p.s.	—	600 $\Omega$	600 $\Omega$	-70 to +40 dbm.	0.3%; 1%; 3%; 10%; 30%; 100%	—	—

### Audio Test Instruments

(Continued from page 72)

- (a) Condenser microphones as sound standards

- (b) Sound-level meters

#### IV Instruments for measurement of characteristics of audio signals

- (a) Distortion and noise meters

- (b) Harmonic and wave analyzers

- (c) Audio spectrum analyzers

- (d) Frequency meters

- (e) Wow meters

#### V Multiple instruments (Signal source/meter in one unit)

- (a) Transmission measurement sets and audio channels

- (b) Intermodulation analyzers

#### VI Accessory units

- (a) Calibrated attenuators

- (b) Auxiliary instrument amplifiers

- (c) Universal impedance bridges

#### VII Miscellaneous measuring and accessory instruments

This classification has been followed in all the listings of test equipment in the various tables in this article, and a complete index indicating where each table may be located is included at the bottom of this page.

The tables themselves are complete and self-explanatory. Each table represents a complete listing of the commercial units which are available for performing the particular function. It also includes the basic specifications, characteristics, and prices of the instruments listed, to aid in their selection to fit specific needs. Wherever certain information is not included in the table, it is because the information is not available or is not listed in the specifications.

There have also been included in this listing certain units which are not strictly considered audio test equipment, but which are useful accessories in performing tests on audio systems. Signal tracers and auxiliary instrument amplifiers might be considered in this category. In these listings a certain amount of judgment has been exercised in deciding what should be considered test equipment and what should be omitted. (For example, commercial broadcast and other audio amplifiers have not been included in the auxiliary amplifier listing, even though some of them may have characteristics superior to those listed.)

The first table lists the names and addresses of all of the manufacturers represented in the various tables, in the event further information about any of the instruments is desired. In many cases, local distributors can also furnish considerable additional information.

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# SELENIUM RECTIFIERS

— and —  
ELECTRONIC COMPONENTS

## THREE PHASE FULL WAVE BRIDGE RECTIFIERS

Input 0-126 VAC	Current	Output 0-130* VDC
Type #		Price
3B7-4	4 AMP.	\$32.95
3B7-6	6 AMP.	48.90
3B7-15	15 AMP.	70.00

Input 0-234 VAC	Current	Output 0-250* VDC
Type #		Price
3B13-4	4 AMP.	\$56.00
3B13-6	6 AMP.	81.50
3B13-15	15 AMP.	120.00

## CENTER TAPPED RECTIFIERS

Input 10-0-10 VAC	Current	Output 0-8* VDC
Type #		Price
C1-10	10 AMP.	\$6.95
C1-20	20 AMP.	10.95
C1-30	30 AMP.	14.95
C1-40	40 AMP.	17.95
C1-50	50 AMP.	20.95
C1-80	80 AMP.	28.95
C1-120	120 AMP.	38.95

## CUSTOM DC POWER SUPPLIES

Built to your specifications.  
For:

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- LABORATORIES
- UNIVERSITIES
- GOVERNMENT AGENCIES

We will be pleased to quote on  
your requirements.

## SINGLE PHASE FULL WAVE BRIDGE RECTIFIERS

Input 0-16 VAC	Current	Output 0-12* VDC
Type #		Price
B1-250	250 MA.	\$0.98
B1-500	500 MA.	1.95
B1-1	1 AMP.	2.49
B1-1X5	1.5 AMP.	2.95
B1-3X5	3.5 AMP.	4.50
B1-5	5 AMP.	5.95
B1-10	10 AMP.	9.95
B1-15	15 AMP.	13.95
B1-20	20 AMP.	15.95
B1-30	30 AMP.	24.95
B1-40	40 AMP.	27.95
B1-50	50 AMP.	32.95
B1-60	60 AMP.	36.95
B1-80	80 AMP.	44.95

Input 0-36 VAC	Current	Output 0-26* VDC
Type #		Price
B2-150	150 MA.	\$0.98
B2-250	250 MA.	1.25
B2-300	300 MA.	1.50
B2-450	450 MA.	1.95
B2-1	1 AMP.	3.95
B2-2	2 AMP.	4.95
B2-3X5	3.5 AMP.	6.95
B2-5	5 AMP.	9.95
B2-10	10 AMP.	15.95
B2-15	15 AMP.	24.95
B2-20	20 AMP.	27.95
B2-30	30 AMP.	36.95
B2-40	40 AMP.	44.95

Input 0-54 VAC	Current	Output 0-38* VDC
Type #		Price
B3-150	150 MA.	\$1.25
B3-250	250 MA.	1.95
B3-600	600 MA.	3.25
B3-5	5 AMP.	13.95
B3-10	10 AMP.	24.95

Input 0-72 VAC	Current	Output 0-50* VDC
Type #		Price
B4-600	600 MA.	\$3.95
B4-3	3 AMP.	14.95
B4-5	5 AMP.	17.95
B4-10	10 AMP.	27.95

Input 0-115 VAC	Current	Output 0-90* VDC
Type #		Price
B6-150	150 MA.	\$1.95
B6-250	250 MA.	2.95
B6-600	600 MA.	5.95
B6-750	750 MA.	6.95
B6-1X5	1.5 AMP.	10.95
B6-3X5	3.5 AMP.	18.95
B6-5	5 AMP.	24.95
B6-10	10 AMP.	36.95
B6-15	15 AMP.	54.95

Input 0-234 VAC	Current	Output 0-190* VDC
Type #		Price
B13-600	600 MA.	\$12.95
B13-1X5	1.5 AMP.	19.95
B13-3	3 AMP.	35.95
B13-5	5 AMP.	48.95
B13-10	10 AMP.	69.95

## RECTIFIER CAPACITORS

CF-14	3000 MFD	12VDC	\$1.69
CF-15	6000 MFD	12VDC	2.95
CF-1	1000 MFD	15VDC	.98
CF-2	2000 MFD	15VDC	1.69
CF-20	2500 MFD	15VDC	1.95
CF-3	1000 MFD	25VDC	1.25
CF-4	2X3500 MFD	25VDC	3.45
CF-5	1500 MFD	30VDC	2.49
CF-6	4000 MFD	30VDC	3.25
CF-7	3000 MFD	35VDC	3.25
CF-8	100 MFD	50VDC	.98
CF-13	500 MFD	50VDC	1.95
CF-16	2000 MFD	50VDC	3.25
CF-21	1200 MFD	90VDC	3.25
CF-9	100 MFD	150VDC	1.69
CF-10	500 MFD	200VDC	3.25
CF-12	125 MFD	350VDC	2.49

## RECTIFIER TRANSFORMERS

All Primaries 115VAC 50/60 Cycles

Type #	Volts	Amps.	Price
XF15-12	15	12	\$3.95
TXF36-2	36	2	3.95
TXF36-5	36	5	4.95
TXF36-10	36	10	7.95
TXF36-15	36	15	11.95
TXF36-20	36	20	17.95
XFC18-14	18VCT	14	5.95

All TXF Types are Tapped to Deliver 32, 34, 36 Volts. XFC Type is Tapped to Deliver 16, 17, 18 Volts Center Tapped.

## RECTIFIER CHOKES

Type #	Volts	Amps.	Price
HY5	.02 Hy	5	\$3.25
HY8X5	.02 Hy	8.5	7.95
HY10	.02 Hy	10	9.95
HY12	.02 Hy	12	12.95
HY1	.015 Hy	15	13.95

## RECTIFIER SURGE PROTECTION

When an inductive DC circuit is opened, a high-voltage surge is produced that may damage a rectifier power supply. This danger can be reduced by the application of a non-linear resistance device known as Thyrite. Further information will be found in Catalog No. 719.

## RECTIFIER MOUNTING BRACKETS

For Types B1 through B6, and  
Type C1 ..... \$0.35 per set  
For Types B13 ..... .70 per set  
For Types B4 ..... .95 per set

## RECTIFIER KIT No. 612-10

0 and 12 VDC at 10 Amps.

This unit will deliver unfiltered direct current for operation of motors, dynamotors, solenoids, electroplating, battery charging and similar equipment.  
The two output voltages can be used simultaneously, and can be varied above and below their nominal ranges.  
Complete with schematic diagram and instructions; Shpg. wt., 12 lbs. \$15.95

## FILTER KITS FOR No. 612-10

1 section choke input, 10% ripple. \$9.64  
2 section choke input. 2% ripple. 19.28

## PILOT LIGHT ASSEMBLIES

Aircraft type, panel mounting, amber jewel. Knurled rim controls "DIM-BRIGHT." Bakelite and aluminum construction. Bulb replaceable from front panel. For single contact bayonet bulbs, up to T-3 1/4 size. Dimensions: 2 1/4" overall length, 3/4" diameter, 5/8" panel mntg. hole. IMMEDIATE DELIVERY. 500 to carton, nested.

Request sample and prices on company letterhead.

WRITE FOR SELENIUM RECTIFIER CATALOG NO. 719 ON COMPANY LETTERHEAD

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COMPANY**

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Phone: BEekman 3-7385-6

## VACUUM CAPACITORS



Standard Brands		
12 Mmfd.	20 Kv	\$4.95
50 Mmfd.	20 Kv	4.95
50 Mmfd.	32 Kv	5.95

## OIL CONDENSERS

2 Mfd. 200VDC Bathub.....	\$0.20
.5 Mfd. 400VDC. Telephone Type....	.20
2 Mfd 400VDC Bathub.....	.30
2X.1 Mfd 600VDC Bathub.....	.39
6 Mfd. 600VDC w/mtg. clamp.....	.79
8 Mfd 660VAC/2000VDC w/brkts....	3.50
15-15 Mfd 8000VDC Voltage Doubler Type 26F381 w/brkts.....	3.95

## SPECIAL—LIMITED QUANTITY

Sprague Vitamin O Photo-Flash Capacitors.  
8 MFD—3000 VDC—36 watt/sec. 4 1/2"x3 3/4"  
x1 1/4". Weight, 1 lb., 12 oz. each.  
Price..... \$5.95 ea.  
**3 for \$15.00**

## ATTENTION!!

Bulletin No. 713, listing various government and commercial surplus items, is now available upon request.

## VOLTAGE REGULATORS

These solenoid operated carbon pile regulators will stabilize the output of 12-18 VDC power supplies, simply by connecting the coil leads across the output of the rectifier, and the carbon element leads in series with the load. Price each. \$2.49

## D-C POWER SUPPLY FTR 3377-AS

Rating 115 VAC to 115 VDC, 77 Amperes. Operates fans, motors, magnetic chucks, business machines, relays, etc. Descriptive literature available.  
Brand new, ready to operate. \$16.50

## D-C PANEL METERS

Attractive, rugged, and reasonably priced. Moving vane solenoid type with accuracy within 5%.  
0-6 Amperes D-C Any range \$2.49 each  
0-12 Amperes D-C  
0-15 Volts D-C

Minimum order \$3.00. No C.O.D.'s under \$25.00. 25% deposit on C.O.D. Add 10% for Prepaid Parcel Post and Handling. Terms: Net 15 days in the presence of approved credit.

All prices subject to change without notice.  
Orders Promptly Filled from Our Stocks  
All Prices F.O.B. our NYC Warehouse



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IN DELUXE PERFORMANCE**

**with ESPEY**

**AUDIO AMPLIFIER  
POWER SUPPLY  
DE LUXE TUNER**

**MODEL 514 AMPLIFIER**

**MODEL 513 TUNER**

**NEW!  
CUSTOM BUILT  
AM-FM Quality CHASSIS**

**Here is exquisite high fidelity in chassis form that will grace the finest cabinet.**

**The 513 De Luxe Tuner** is easy to install in any console cabinet, old or new and embodies the latest engineering refinements for lasting high quality at a price that defies competition.

The Espey 513 Tuner employs 10 tubes plus tuning indicator in a super heterodyne circuit and features a drift compensated circuit for high frequency stability, tuned RF on AM and FM plus phono input provision, and separate AM and FM antennas.

**Model 514 De Luxe Power Supply-Audio Amplifier** is designed specifically to work in conjunction with Model 513 Tuner, and is also used wherever a high quality audio amplifier is required.

With an output of 25 watts, Model 514 features a parallel push pull output circuit, self balance phase inverter system, extended range high fidelity response, and inverse feedback circuit.

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BC-455, 6 to 9 MC receiver.  
USED, like NEW.....\$7.95

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COMMERCE at FIFTH ST.  
Fort Worth 2, Texas

HAS THE SENSATIONAL NEW  
221-K VTVM KIT  
IN STOCK!

 \$23.95

## Within the Industry

(Continued from page 28)

the organization of manufacturers' representatives that bears his name. Besides his work with that group, he is national secretary-treasurer of "The Representatives" of Radio Parts Manufacturers, Inc.

**ALBERT DELIGHTER** has been named assistant to the president of *Standard Transformer Corporation*, Elston, Kedzie, and Addison Sts., Chicago, Ill.



A native of Chicago, Mr. Delighter joined the firm three years ago and was employed in the accounting and cost accounting departments. He attended Northwestern University and Carleton College and is a veteran of the Army Air Corps.

**"THE REPRESENTATIVES"** of Radio Parts Manufacturers, Inc., Los Angeles Chapter, elected three sales representatives to the group, bringing the total membership to 47 and making it one of the largest regional chapters within the national organization.

Elected to senior membership were Robert M. Hardie and Richard E. Osborne, both of 1127 Wilshire Blvd., Los Angeles 14, California. Frederick Ireland, 1000 No. Seward Ave., Hollywood 88, California, was made an associate member.

**GEORGE G. EDLEN**, a recent addition to the sales organization of *M. J. Shapp and Co.*, 121 N. Broad St., Phila., Pa., will make his headquarters in Baltimore and will contact manufacturers and government agencies in the Baltimore-Washington area. A graduate physicist, Mr. Edlen has done radar research at M.I.T., and prior to joining the *Shapp Co.* was research engineer at Johns Hopkins in Baltimore.

**KEN STARKEY** is the new general manager of the *Pilgrim Distributing Company*, 910 W. Jackson Blvd., Chicago, Ill., which handles *Sylvania*, *Radiart*, *Amphenol*, *Centralab*, *Jerrold*, *Webster*, *Quam Nichols*, *Astatic*, and *Merit* products, besides those of companies in other fields. Mr. Starkey brings a wide experience in the radio parts industry to his new post. . . . **SAM M. HARPER**, former sales executive for *John Meck Industries, Inc.*, of Plymouth, Indiana, has been given the post of director of the company's special products division. Mr. Harper will carry on his duties at the Plymouth location and will supervise development and sales of contract and private label TV items. . . . The new advertising and sales promotion manager of the *Trans-Vue Corporation* will be **FIL MANDL**, who was previously associated with the *Harry J. Lazarus Advertising Agency* in Chicago.



# WAR SURPLUS - SPECIAL SALE!

## BC-604 TRANSMITTER FM 20-28 MC

11 and 15 meters. Can be operated on 10 meters—10 channel push button crystal. With all tubes and meter but less dynamotor.

Excellent Condition .... **\$12.95**  
Crystals—Set of 80 .... **14.95**

## BC-605 INTERPHONE AMPLIFIER

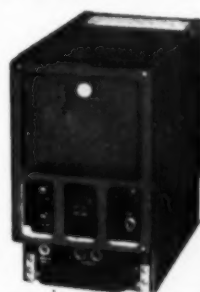
Easily converted to an ideal inter communications set for office—home—or factory.

Original—New..... **\$4.95**  
Like New..... **3.95** } with schematic

## CONVERSION DIAGRAM AND INSTRUCTIONS complete with necessary parts.

This kit consists of 3 tubes—2 speakers—1 speaker baffle (for remote speaker)—100 ft. 2-cord cable—1 switch—1 line cord—2 etched plates—miscellaneous resistors—condensers—hardware—and all that is necessary to convert.

New **\$8.25**



## AN/APN-4

Indicator: Uses 5 CP1, Loran, convert to test scope, panadapter, etc. Contains extremely accurate 100 kc rtal to time sweeps and marker pips at 2, 20 and 100 kc. Two parallel horizontal sweeps, obtain time differences between signals, between half power points on passband curves, and numerous other scope uses. Experimenters' delight! Use the counter circuits to try the new system of FM demodulation (July Proc. IRE) or to time camera shutters, 25 tubes. Condition: used, excellent. With schematic ..... **\$29.50**

## RECEIVER Easily Converted for Use in Citizens Band

Crystal Controlled Local Oscillator. Broad Band Pass—20.7 MC I.F.'s. Complete with 7-6AJS, 1-12SR7, 2-12SN7, 1-28D7, relays, crystals. Schematic furnished ..... Used **\$7.95**

## NEW CATALOG

listing many surplus values, write for your **FREE** copy TODAY.

## DYNAMOTORS

DM-28—For BC-348 with Mount and Filter ..... New **\$6.95**  
Used **3.95**  
DY-12—For ART-13 less filter and base ..... New **9.95**  
Used **.95**  
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BD-77 ..... New **5.95**  
PE-206 ..... New **6.95**  
Used **2.75**  
PE-101 ..... New **2.75**  
DM-53 ..... New **3.95**  
(3 for \$2.00) Used **.95**  
DM-32 ..... New **1.95**  
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**SURPRISE PACKAGE** 20 lbs. Ass't radio parts. **\$1.95**  
A \$25.00 value for only.

**RESISTOR KIT**—(Long leads New)  
100 Ass't'd ..... **98¢**

## COMMAND (SCR 274 N) EQUIPMENT

	Used	New
BC-453	<b>\$12.95</b>	
BC-454	<b>4.95</b>	<b>16.95</b>
BC-455	<b>7.95</b>	
BC-456	<b>1.95</b>	<b>2.95</b>
BC-457	<b>5.95</b>	
BC-458	<b>9.95</b>	<b>7.95</b>
BC-459 (or T22)	<b>9.95</b>	
BC-696 (or T19)	<b>14.95</b>	<b>24.95</b>
ARCS Transm. 2.1-3MC	<b>9.95</b>	
BC-450—3 Receiver Remote Control	<b>.89</b>	<b>1.95</b>
BC-442		<b>2.95</b>
3 Receiver Rack	<b>1.95</b>	
2 Transmitter Rack	<b>1.50</b>	

Complete Command set as removed from aircraft—3 receivers—2 transmitters—Relay unit—control boxes—mounting racks—plugs—modulator and dynamotors—crated. Set **\$34.50**

## SPECIAL

Tubular—and—"FP"—AC-DC popular brand condensers—Good numbers—High and low voltages.....10 Ass'd. **\$1.69**

**BC-520 F.M.—Receiver—Transmitter—2 channel crystal—Freq. 20-27.8 MC, 13 tubes—metered plate and fil**

New **\$14.95**

**PE-97 6-12 Volt Vibrator Power Supply for BC 620.**

Excellent—used—complete..... **\$6.95** Less Vibrator—tubes—condenser **\$2.95**

**FT-250 Mount for PE-97 and BC-620** ..... **\$1.50**

## BC-223

**Ideal Marine or Ham Transmitter  
2000 to 5250 KC**

New with all tuning units and T.U.  
cases ..... **\$29.50**  
Tuning Units—For BC-223 ..... **2.50**  
Cases—for Tuning Units—for BC-223 **.95**

## MIKES—HEADSETS

HS-23 Hi Imp.....	New	<b>\$2.95</b>
HS-33 Lo Imp.....	New	<b>2.95</b>
HS-30 Hi Imp.....	New	<b>1.50</b>
	Used	<b>.79</b>
T-17D Carbon Mike.....	New	<b>2.75</b>
T-24 Hi Imp. Carbon Mike.....	New	<b>1.19</b>
T-30 Throat Mike.....	New	<b>.98</b>
T-45 (or Navy) Lip Mike.....	New	<b>.98</b>
CD-307 Extension Cord for Headsets.....	New	<b>.59</b>

## MISCELLANEOUS SPECIALS

ARB Receiver 200 to 9000 Kc. ....	Exc., Used	<b>\$19.95</b>
AVT 120 Receiver 2300 to 6500 Kc. ....	Used	<b>4.95</b>
SCR 522 Transceiver 100 to 156 MC. ....	Used	<b>34.95</b>
BC 1206 Receiver 200 to 400 KC.....	New	<b>5.95</b>
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MN 26 C or Y Receiver.....	New	<b>24.95</b>
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RA 10 DA Receiver.....	New	<b>24.95</b>
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AM 61 Indicator Amplifier.....	New	<b>12.50</b>
BC 929 Scope.....	New	<b>17.95</b>
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APS-13 UHF Antenna—Suitable for 400 MC citizen band, ideal for UHF experimenters. With director and reflector elements.....	Brand New. 2 for	<b>98¢</b>

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	Each
2 mfd. 4000 VDC G.E.....	<b>\$2.95</b>
	4 for <b>10.00</b>
2 mfd. 5000 VDC. G.E.....	<b>3.95</b>
	3 for <b>10.00</b>
1 mfd. 6000 VDC.....	<b>2.75</b>
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.25 mfd. 15000 VDC.....	<b>4.95</b>
.00025 mfd. 25000 VDC.....	<b>2.95</b>

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304 TL.....	90c each.....	4 for <b>\$3.00</b>
5BP1.....		<b>1.95</b>
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4AP10.....		<b>1.95</b>
211.....		<b>.49</b>
1625.....		<b>.29</b>
872A-GE.....		<b>2.95</b>
872A.....		<b>1.29</b>

## BEAM INDICATORS

I 82—5".....	New	<b>\$4.95</b>
Transmitter selsyn for above.....		<b>\$2.45</b>
	both for	<b>7.00</b>
I 81—3".....	New	<b>\$3.45</b>
Transmitter Selsyn for above.....		<b>\$2.45</b>
	both for	<b>5.25</b>
I 81.....	Used	<b>2.45</b>

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**... THE FIRST  
PRACTICAL,  
EASY-TO-INSTALL,  
LOW COST  
TV MAST**

- Easy to handle—easy to climb
- Mounts any type of TV antenna
- 40' Trylon mast and antenna installed by 2 men in 3 hours or less—at mast cost of about \$1 per foot!

Now you can get all the height you want for TV antennas—at little more than the cost of makeshift mast devices—and twice as easily installed! Trylon TV Antenna Masts are made in handy 10' sections. They weigh only about 2 lbs. per foot! Sections can easily be joined for mast heights of 20', 30', 40', 50' or 60' as desired. Triangular in shape, formed of double-welded "serpentine" steel rod construction, they can be mounted on either flat or peaked roofs and climbed like a ladder. Clamp-on working platforms are available for installation or adjustment of antennas. Safe, durable, fully tested in numerous installations.

### WRITE TODAY!

Folder and price list giving full details of Trylon TV Masts and accessories now available. Write today. One out of every 4 TV users is an immediate prospect!

**WIND TURBINE CO.**

Tower and  
Antenna Division

WEST CHESTER • PA.



# THE AUDIO COMPARATOR

**Novel test unit permits selection of a minimum of 9100 basic audio component combinations for comparison.**

**B**ECAUSE high-fidelity audio fans are skeptical of beautifully-printed response curves and advertising claims, Boston's *Radio Shack Corporation* has given them an entire room dedicated to the premise that the listener's own two ears can best decide what is best for him—in terms of reproduction quality and of economy. Confirmed skeptics find an oscilloscope, an audio oscillator, and sweep frequency records available for extra jury duty!

Although this room, called *The Radio Shack "Audio Comparator"* (hear and compare), was opened in 1947, it has been growing to meet the demands of an expanding industry and of an increasingly informed audience to whom 15,000 c.p.s. does not admit the necessity for "within 5%."

Today the "Audio Comparator" is capable of a minimum of 9100 basic audio component combinations (total number *unlimited*) quicker than you can say "Fletcher-Munson"—without losing a single note of music when switching from one combination to another. The equipment involved includes pickups, turntables, changers, amplifiers, tuners, loudspeakers, wire and tape and disc recorders, microphones, and test instruments.

The "Audio Comparator" was designed not only for the convenience of customers in choosing equipment, but also for the use of *The Radio Shack* engineering department as a guide to purchasing and for debunking false or misleading claims. Suggestions to manufacturers, made after exhaustive "Audio Comparator" aural and visual tests, have often resulted in the improvement of new equipment for the

benefit of the industry and the public.

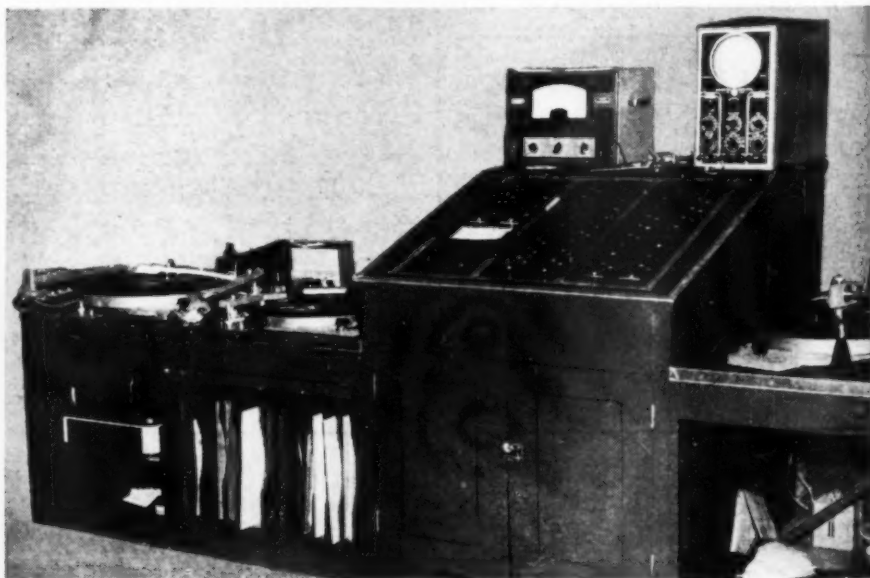
Many comparisons result in answers unobtainable by other methods. For example, take this typical microphone test. Mikes are grouped together, the amplifier is selected, disc or tape recorder is selected, sound source (voice or music) is selected, and then the mikes are switched. The result is a recording from which the listener may actually determine sensitivity, directivity, and quality. Equally important, he hears the mikes as *reproduced* by a speaker without the accompaniment of the originating sound source—as in the case of feeding the amplifier into a speaker instead of a recorder while the mikes are being compared.

In simultaneous comparisons of tape, wire, and disc recorders, constant tone of the a.f. generator is applied for "wow" test, and the sweep frequency generator for over-all response in conjunction with the oscilloscope. Phono records and radio may also be recorded as part of the test.

For the music lover who already owns, let us say, an adequate amplifier-pickup combination, but who wishes to improve his speaker installation, the procedure is as follows. His amplifier and pickup are duplicated by switching in like or similar equipment on the panel board. A record is played—preferably one of the listener's *own* records so that his familiarity with it will eliminate the possibility that a *Radio Shack* record might sound "better." Then a speaker similar to his present model is switched in.

From this familiar and unprejudiced norm, his own ears lead him to the selection that best fits his requirement, taste, and budget.

The audio comparator shown can be used to check all types of audio equipment.





# PERMALLOY SHIELDS

for CATHODE RAY TUBES

3" Shield.....\$1.47  
5" Shield.....1.97



NOW AVAILABLE

1000 KC Crystal.....\$2.97  
Socket......07

## TUBES!! BRAND NEW! STANDARD BRANDS! NO SECONDS! COMPARE! TUBES!!

1B21.....\$ 2.87	3EP1.....\$ 2.87	305A.....\$12.95	843.....\$ .39	C100D.....\$ 1.95	O1A.....\$ .25	6A6.....\$ .89	6U5.....\$ .65	10.....\$ .98
1B22.....3.95	3EP2.....8.97	207A.....3.95	845W.....4.25	CK507AX.....1.95	1A3......57	6A7......69	6U7G......85	24A......67
1B23.....8.95	3EP7.....1.75	316A......54	851.....15.95	CK100S......19	1A4.....1.09	6A8......79	6V6......97	25L6......83
1B24.....4.69	3CP1.....1.75	327A.....2.75	860.....2.49	CK100E......98	1A5......97	6AB7......79	6V6GT......63	25Z5......49
1B26.....4.57	4-65A.....14.49	338A.....3.95	861......49	CK1090.....2.95	1A5GT......79	6AC7......77	6X4......26	25Z6......49
1B27.....8.95	4-125A.....27.45	250A.....1.25	864......49	EF50......45	1A6......79	6AF6G......79	6X5GT......49	25Z7......49
1B29.....3.49	4-250A.....37.45	350B.....1.89	865.....2.95	F123A.....12.95	1A7GT......67	6AG5......77	6Y6G......67	25Z8......49
1B36.....4.59	4AP10.....5.95	353A.....2.95	866A.....1.65	F125A.....14.95	1A8S......69	6AG7......78	6Z7G.....1.15	25Z9......49
1B38.....4.75	4B24.....3.95	353B.....7.95	866JR.....27.95	F127A.....27.50	1B4.....1.19	6AH6.....1.29	6ZV50......69	28D7......35
1D21.....5.75	4C35.....1.95	382A.....1.95	869H......87	F128A.....69.50	1B5/25S......89	6AJ5......79	7A4/XXL......59	30......35
1N21.....1.65	4E27.....17.75	368AS.....3.95	872A......87	F606.....22.50	1C5GT......67	6AK5......85	7A6......67	31......89
1N21B......79	4J32.....97.50	371B......85	874......87	F660.....125.00	1C6......89	6AK6......79	7A7......57	32......97
1N23......79	5AP1.....1.95	388A.....2.95	876......98	F862A.....450.00	1C7G......89	6AL5......65	7AC7......72	32L7GT......97
1N23B.....1.95	5AP4.....1.95	393A.....3.85	878.....1.98	FG17.....2.89	1D5GP......97	6AQ5......89	7B4......57	33......69
1N34......79	5BP1.....1.89	304A.....14.50	884.....1.39	FG27A.....9.75	1D7G......89	6AQ6......89	7B6......39	34......69
1N34B......79	5BP4.....3.75	417A.....14.50	885.....1.39	FG81A.....3.85	1D8GT......95	6AT6......47	7B7......39	35......69
1N37.....3.95	5CP1.....1.85	434A.....3.50	902P1.....3.85	FG95.....17.95	1F4......75	6AU6......59	7C4......37	35/51......57
2AP1.....3.89	5CP1A.....9.95	446A.....1.25	905.....3.98	FG105.....9.95	1F5G......75	6AV6......47	7C5......37	35A5......67
2C21......27	5CP7.....9.95	450TH.....17.95	908.....4.95	FG172.....19.95	1G4GT......69	6B4G......89	7C7......59	35B5......65
2C22......19	6C30.....7.95	450TL.....37.50	923......97	FT210.....13.95	1G6GT......69	6B6G......79	7E5......67	35C5......65
2C26......27	6D21.....27.95	521A......85	931A.....2.49	GL451.....3.25	1H5GT......54	6B7......89	7E7......69	35L6......54
2C34......27	6EP7.....1.35	550......85	953B.....19.95	GL562.....85.00	1H6GT......87	6B8G......89	7F7......69	35V4......39
2C40.....6.39	6GP1.....5.95	575A.....12.95	954......37	GL697.....65.50	1J6GT......87	6BA6......55	7H7......64	35Y4......39
2C43.....8.95	5JP1.....24.95	700A/B/C/D.....34.50	955......37	HY115......85	1L4......55	6BE6......57	7H7......64	35Z4......39
2C44......67	5JP2.....11.75	701A.....3.60	956......39	HY165......79	1L4A......57	6BF6......57	7H7......64	35Z4......39
2C46.....6.87	5JP3.....17.50	702A.....3.25	957......39	HY165......79	1L4A......57	6BF6......57	7H7......64	35Z4......39
2C51.....3.25	5JP4.....9.50	703A.....3.95	958A......35	KC4.....49.50	1L4B......89	6B7......89	7H7......64	35Z4......39
2D21.....1.17	5LP1.....13.95	705A.....1.10	959......37	KL610.....9.75	1L5C......57	6B8G......89	7H7......64	35Z4......39
2E22.....1.29	5NP1.....2.89	706CY.....18.75	991......27	ML100.....49.50	1L6C......57	6C4......25	7H7......64	35Z4......39
2E24.....4.87	6C21.....19.69	707B.....14.95	1003.....3.95	ML101.....139.50	1L6D......57	6C5......47	7H7......64	35Z4......39
2E26.....3.49	6F4.....5.59	708A.....3.95	1011......39	ML501.....149.50	1L6E......57	6C6......47	7H7......64	35Z4......39
2I21A.....10.95	6J4.....5.95	708A.....3.95	1011......39	ML501.....149.50	1L6E......57	6C6......47	7H7......64	35Z4......39
2I22.....3.25	6J4.....5.95	708A.....3.95	1011......39	ML501.....149.50	1L6E......57	6C6......47	7H7......64	35Z4......39
2I23.....7.95	9CP7.....12.50	714A.....12.95	1614.....1.45	REL21.....2.95	1L6F......57	6C6......47	7H7......64	35Z4......39
2I27.....13.95	9JP1.....6.95	714AY.....3.95	1616......98	REL36......79	1L6G......57	6C6......47	7H7......64	35Z4......39
2I30.....49.50	9LP7.....2.25	715C.....24.95	1619......24	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I31.....9.75	10BP4.....24.95	717A......59	1624......98	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I32.....5.95	10Y.....1.49	721A.....2.95	1625......37	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I33.....19.95	12DP.....14.95	725A/B.....24.95	1626......37	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I34.....19.95	12GP7.....13.95	725A/B.....24.95	1626......37	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I37.....17.50	12HP7.....13.95	726A.....8.95	1630.....3.95	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I38.....12.95	15E.....1.29	726A.....8.95	1631.....1.45	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I39.....34.50	15R......79	730A.....10.95	1632......98	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I40.....49.50	16D......27	730A.....10.95	1632......98	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I46.....8.95	24C......35	801A.....1.95	1633.....4.75	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I48.....39.50	30 Spec......29	802.....4.25	1641......69	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I49.....24.95	45 Spec......29	803.....4.25	1642......69	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I50.....42.50	75TL.....2.95	804.....8.95	1642......69	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I53.....14.95	100R.....1.85	804.....8.95	1642......69	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I54.....39.50	100S.....1.85	804.....8.95	1642......69	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I61.....39.50	100TS.....2.35	807.....1.10	1960.....2.95	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2I62.....39.50	204A.....57.50	808.....1.39	2050......75	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2K25.....23.95	205B.....1.75	809.....2.75	2051......75	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
2K28.....14.95	211......49	810.....6.95	7193......19	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3AP1.....4.85	215A......65	811.....2.10	8005.....4.75	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3B22.....2.49	217C......95	812.....2.79	8011......49	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3B23.....4.85	218......49	812H......69	8012.....1.47	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3B24.....1.59	221A.....1.95	813.....7.75	8013A.....1.45	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3B25.....4.87	225.....8.70	814.....2.75	8014A.....22.50	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3B26.....1.79	227A.....2.95	815.....2.45	8016.....1.25	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3B27.....3.85	231D.....1.25	816.....1.10	8020.....3.25	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3B28.....2.49	249B......49	826......42	826......42	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3C21.....5.95	249C.....2.89	829B.....7.45	9001......37	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3C22.....39.50	250R.....7.45	830B.....3.49	9002......34	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3C23.....2.47	250TH.....18.95	832A.....4.25	9003......37	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3C24......45	250TL.....18.95	833A.....32.50	9004......37	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3C30......45	274B.....1.19	9005.....5.75	9005.....5.75	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3C31.....3.49	282B.....7.75	934......49	934......49	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3CP1.....2.67	294A.....4.57	937.....1.69	C5B.....7.95	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3D21A.....1.49	304TH.....4.95	938.....3.25	C6A.....8.45	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39
3DP1.....1.97	304TL.....1.39	941......49	C6J.....4.95	REL21.....2.95	1L6H......57	6C6......47	7H7......64	35Z4......39

### OIL CONDENSERS

ALL RATINGS DC

.25mfd. 600v \$0.37	1mfd. 2000v \$1.07
.5mfd. 600v .37	2mfd. 2000v 1.47
1mfd. 600v .37	4mfd. 2000v 3.77
2mfd. 600v .37	8mfd. 2000v 3.77
2x2mfd. 600v .77	15mfd. 2000v 4.95
4mfd. 600v .57	1mfd. 2500v 1.45
6mfd. 600v .97	2mfd. 2500v 1.77
8mfd. 600v 1.07	3mfd. 2500v 1.98
10mfd. 600v 1.27	5mfd. 3000v 1.75
.25mfd. 1000v .47	2mfd. 3000v 2.65
.5mfd. 1000v .57	5mfd. 3000v 2.75
1mfd. 1000v .67	1mfd. 3000v 2.98
2mfd. 1000v .77	2mfd. 3000v 3.47
4mfd. 1000v 1.17	4mfd. 3000v 4.45
8mfd. 1000v 1.97	12mfd. 3000v 6.97
10mfd. 1000v 2.07	1mfd. 4000v 4.25
15mfd. 1000v 2.47	2mfd. 4000v 4.85
20mfd. 1000v 3.27	3mfd. 4000v 5.45
.5mfd. 1500v .97	1mfd. 5000v 4.98
1mfd. 1500v .97	4mfd. 5000v 5.45
2mfd. 1500v 1.17	1mfd. 7000v 2.97
4mfd. 1500v 1.77	.01mfd. 7500v 2.45
2mfd. 1500v 5.47	.02mfd. 7500v 2.75
.1mfd. 2000v 1.07	.03mfd. 7500v 2.97
.25mfd. 2000v 1.17	1mfd. 7500v 6.95
.5mfd. 2000v 1.27	.02mfd. 12000v 9.97

### HIGH CAPACITY CONDENSERS

ALL RATINGS DC

2x3500mfd. 25v \$3.47	200mfd. 35v \$ .57
2500mfd. 3v .35	100mfd. 50v .45
3000mfd. 25v 2.45	4000mfd. 15v 1.95
4000mfd. 30v 3.25	4000mfd. 25v 2.25
2x1250mfd. 10v 1.27	2350mfd. 24v 2.25
1000mfd. 15v .98	1000mfd. 25v 4.57

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3350v @ .025 arms.....	\$12.95
2500v @ 4 ma; 6.3v @ 1A; 24v @ 2A.....	5.97
2500v @ 15 ma.....	3.97
1700v @ 4 ma; 6.3v @ 1A; 24v @ 2A.....	4.98
1600v @ 4 ma; 700v CT @ 150 ma; 6.3v @ 9A.....	4.97
1500v @ 7 ma; 2.5v @ 1.75A.....	4.47
525-0-525v @ 60 ma; 925v @ 10 ma; 2x5v @ 3A; 6.3v @ 3.6A; 6.3v @ 2A; 6.3v @ 1A.....	6.97
500-0-500v @ 175 ma.....	4.95
500-0-500v @ 25 ma; 262-0-262v @ 55 ma; 6.3v @ 1A; 2x5v @ 2A.....	4.45
425-0-425v @ 75 ma; 5v @ 3A; 6.3v @ 1.5A.....	3.98
400-315-0-100-315v @ 200 ma; 2.5v @ 2A; 5v @ 3A; 2x6.3v @ 9A.....	5.95
385-0-385-550v @ 200 ma; 2.5v @ 2A; 5v @ 3A; 3x6.3v @ 6A—pri 110/220.....	6.27
385-0-385v @ 70 ma; 2.5v @ 10A; 5v @ 6A; 5v @ 3A.....	4.95
340-0-340v @ 300 ma; 1540v @ 5 ma.....	4.95
600v CT @ 100 ma; 5v @ 2A; 124v @ 2A; 124v @ 3A.....	3.37
300-0-300v @ 65 ma; 2x5v @ 2A; 6.3v @ 24A; 6.3v @ 1A.....	3.47
255-0-255v @ 240 ma; 325-0-325v @ 12 ma.....	4.98
120-0-120v @ 50 ma.....	.97
80-0-80v @ 225 ma; 5v @ 2A; 5v @ 4A.....	3.49
36v @ 15A.....	9.95
18v @ 15A.....	8.95
12.6v CT @ 10A; 11v CT @ 6.5A.....	6.95
12v CT @ 10A; 2x9v CT @ 10A.....	7.49
3x10-3v CT @ 7A.....	6.95
8v CT @ 1A.....	.97
6.3v @ 214A; 6.3v @ 2A; 24v @ 2A.....	4.45
6.3v @ 12A; 6.3v @ 2A; 115v @ .1 amps.....	3.45
6.3v @ 10A; 6.3v @ 6A.....	2.47
6.3v CT @ 3.5A; 2x2.5v @ 3A.....	2.97
6.5v @ 8A; 6.5v @ 5A; 5v @ 3A; 2.5v @ 1.75A.....	4.45
5v @ 1A; 2.5v @ 2A; 2.5v @ 1A.....	.77
5v @ 20A; 10KV ins.....	9.97
5v @ 3A; 2.5v @ 2A.....	2.97
2.5v @ 15Arms.....	1.77
2.5v @ 10Arms.....	.97



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PRECISTORS are principally designed for uses where carbon compositions are unsuited and wire wound precisions too expensive. They are excellent in television, voltmeter multiplier, and high frequency circuits. PRECISTORS are supplied in 2 sizes: Type DCF—200 ohms to 5 megohms and Type DCH—500 ohms to 20 megohms.

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**INTERNATIONAL RESISTANCE CO.**

*Wherever the Circuit Says ~~~*

**IRC**

**GUARANTEED  
ACCURACY  
1%**

**PLUS**

**STABILITY  
OVER LONG  
PERIODS**

**PLUS**

**LOW  
COST**

**PLUS**

**WIDE RANGE  
OF  
VALUES**

**PLUS**

**PRECISION  
PACKAGING  
in tubular  
plastic case**

## WMOR—Supersonic Tone

(Continued from page 61)

tio. The pickup cartridges for lateral work are variable reluctance types with diamond styli. The high vertical compliance of these cartridges is a major factor in reducing surface noise.

Almost all recording work is done on tape. A *Magnecorder* PT-6 and PT-7 are used for this, utilizing both 7½ and 15 inches-per-second tape speeds. With proper equalization, the recordings have a response above 15,000 c.p.s., using fast speed, and above 8000 c.p.s. with the low speed. When disc recordings are to be made, they are usually taken from tape.

The transmitter proper consists of a G-E ten kw. final amplifier using 5518's in a grounded-grid circuit. Two 7D21's provide 3 kw. of drive to the final. This may seem excessive at first, but a great deal of the IPA power goes "right on through," thus effectively increasing the apparent efficiency of the final. The antenna consists of a four-section RCA pylon, which is an evolution from a folded dipole.

Station WMOR is owned and operated by a group of ex-GI's, each of whom had the desire to own his own business. Pooling resources and capital, they formed a corporation, enlisting the cooperation of a few interested businessmen. Each was a specialist in his own field, and all felt that there was a market for what they had to offer, namely, good radio for the Chicago area.

A sample of true fidelity in the symphonic vein was given the Midwest this past summer when WMOR broadcast the entire series of open-air concerts at Grant Park. The line to the station was equalized to well beyond 15,000 c.p.s., and great care was taken over the strategic placement of microphones. Only one mike was used in the focus of the bandshell to pick up the entire seventy-five-piece orchestra. A noticeable improvement was discernible not only on receivers with wide-band amplifiers and coaxial speaker systems, but even in table model sets with small speakers. The programs were picked up off the air by other stations in outlying areas and rebroadcast to further increase the area served.

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### Surplus Equipment TROUBLE SHOOTING MANUALS

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BC-779 (Super-Pro) Receiver  
SCR-522 Transmitter-receiver  
BC-610 Transmitter

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**GENERAL TEST EQUIPMENT**  
38 Argyle Buffalo 9, N. Y.

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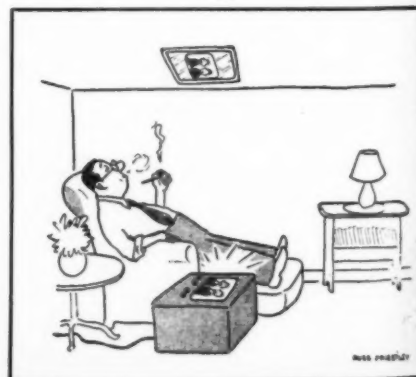
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**RADIO & TELEVISION NEWS**



# ★ SPECIALS ★

## ELECTROLYTIC CONDENSERS

New Stock—Not Surplus  
D.Y. TYPE LUG TERM.  
18c ea. 10 For \$1.50

MFD.	VOLT
30	250
40	200
50	150
60	100
70	50
80	25
90	10
100	5
150	2.5
200	1.5
250	1
300	.75
350	.5
400	.35
450	.25
500	.2
550	.15
600	.1
650	.075
700	.05
750	.035
800	.025
850	.015
900	.01
950	.0075
1000	.005
1100	.0035
1200	.0025
1300	.0015
1400	.001
1500	.00075
1600	.0005
1700	.00035
1800	.00025
1900	.00015
2000	.0001

29c ea. 10 For \$2.50

MFD.	VOLT
2x10	300
2x20	250
2x30	200
2x40	150
2x50	100
2x60	50
2x70	25
2x80	10
2x90	5
2x100	2.5
2x150	1.5
2x200	1
2x250	.75
2x300	.5
2x350	.35
2x400	.25
2x450	.2
2x500	.15
2x550	.1
2x600	.075
2x650	.05
2x700	.035
2x750	.025
2x800	.015
2x850	.01
2x900	.0075
2x950	.005
2x1000	.0035
2x1100	.0025
2x1200	.0015
2x1300	.001
2x1400	.00075
2x1500	.0005
2x1600	.00035
2x1700	.00025
2x1800	.00015
2x1900	.0001
2x2000	.000075

MFD.	VOLT	PRICE
2x10	300	.45
2x20	250	.45
2x30	200	.45
2x40	150	.45
2x50	100	.45
2x60	50	.45
2x70	25	.45
2x80	10	.45
2x90	5	.45
2x100	2.5	.45
2x150	1.5	.45
2x200	1	.45
2x250	.75	.45
2x300	.5	.45
2x350	.35	.45
2x400	.25	.45
2x450	.2	.45
2x500	.15	.45
2x550	.1	.45
2x600	.075	.45
2x650	.05	.45
2x700	.035	.45
2x750	.025	.45
2x800	.015	.45
2x850	.01	.45
2x900	.0075	.45
2x950	.005	.45
2x1000	.0035	.45
2x1100	.0025	.45
2x1200	.0015	.45
2x1300	.001	.45
2x1400	.00075	.45
2x1500	.0005	.45
2x1600	.00035	.45
2x1700	.00025	.45
2x1800	.00015	.45
2x1900	.0001	.45
2x2000	.000075	.45

MFD.	VOLT	PRICE
2x10	300	.45
2x20	250	.45
2x30	200	.45
2x40	150	.45
2x50	100	.45
2x60	50	.45
2x70	25	.45
2x80	10	.45
2x90	5	.45
2x100	2.5	.45
2x150	1.5	.45
2x200	1	.45
2x250	.75	.45
2x300	.5	.45
2x350	.35	.45
2x400	.25	.45
2x450	.2	.45
2x500	.15	.45
2x550	.1	.45
2x600	.075	.45
2x650	.05	.45
2x700	.035	.45
2x750	.025	.45
2x800	.015	.45
2x850	.01	.45
2x900	.0075	.45
2x950	.005	.45
2x1000	.0035	.45
2x1100	.0025	.45
2x1200	.0015	.45
2x1300	.001	.45
2x1400	.00075	.45
2x1500	.0005	.45
2x1600	.00035	.45
2x1700	.00025	.45
2x1800	.00015	.45
2x1900	.0001	.45
2x2000	.000075	.45

MFD.	VOLT	PRICE
2x10	300	.45
2x20	250	.45
2x30	200	.45
2x40	150	.45
2x50	100	.45
2x60	50	.45
2x70	25	.45
2x80	10	.45
2x90	5	.45
2x100	2.5	.45
2x150	1.5	.45
2x200	1	.45
2x250	.75	.45
2x300	.5	.45
2x350	.35	.45
2x400	.25	.45
2x450	.2	.45
2x500	.15	.45
2x550	.1	.45
2x600	.075	.45
2x650	.05	.45
2x700	.035	.45
2x750	.025	.45
2x800	.015	.45
2x850	.01	.45
2x900	.0075	.45
2x950	.005	.45
2x1000	.0035	.45
2x1100	.0025	.45
2x1200	.0015	.45
2x1300	.001	.45
2x1400	.00075	.45
2x1500	.0005	.45
2x1600	.00035	.45
2x1700	.00025	.45
2x1800	.00015	.45
2x1900	.0001	.45
2x2000	.000075	.45

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580VCT	.040	6.3V/1.8, 6.3V/6	2.29
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		5VCT/3	

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600VCT	.0165	2.49	246VCT	.861	3.95
250VCT	.077	4.95	126V	1.5	1.95
600V	.450	24.00	132V	1.5	2.25
1470VCT	1.2				

Filament Transformers—115v/50-60 cps input

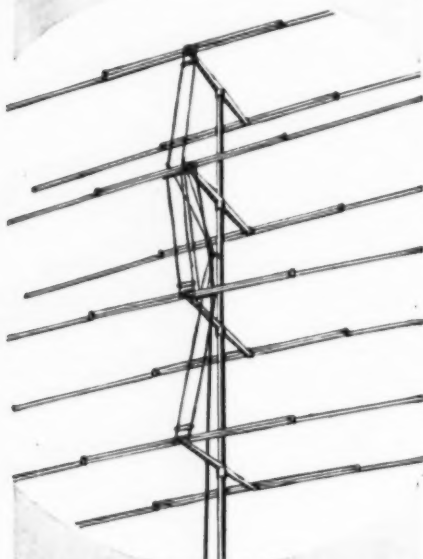
Rating	Each	Rating	Each
2.5V/5A HV INS	\$1.79	6.3VCT/1A, 5V/2A	\$1.85
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6.3V/5A, 6.3V/1A	2.25	6.3V/2.5A, 2.5V/7A	3.25
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5V/6A	2.25	6V/3A	

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210/220/230 60 Cy	13.5V/1.11 Amp	1.95
230V 60 Cy	2.5VCT/4A	2.95
230V 60 Cy	2.5V/6A	2.95
230V 60 Cy	200V/20A, 4x6.3V/9A	2.95
220/440V 60 Cy	28VCT/200 MA	2.95
220V 60 Cy	260V/.03A, 100V/1A, 6.3V/4.2	2.39
220V 60 Cy	700VCT/75 MA, 40VCT/1A	2.95
45/78/90V	15/10/15V, 1 Amp 1V to 10V Tapped	2.95
220V 60 Cy	2x40V/.05 MA, 2.5V/6A, 12.6V/1A	2.95
220V 60 Cy	24V/6A, 5V/3A, 2x6.3V/1A	2.29
43/78/90/115/180/230	2.5V/6.5A, 2.5V/6.5A, 6.3V/4A	3.95
110/115/120/125 230V 60 Cy	6/12/18/24/75/100/115V 150 MA 5V/9A HV INS	2.49 4.25
200V 60 Cy	700VCT/08A, 110VCT/08A	4.25
230V 60 Cy	24V/08A, 6.3V/3, 6.3VCT/1A	4.25
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230V 60 Cy	110V/200 MA, 33V/200 MA, 150V 10A, 1.4V/10A, 150V/150 MA	5.95
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3

NAME .....

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## Loudspeaker Enclosures

(Continued from page 38)

inch loudspeakers consisting of four rows of eight speakers occupies approximately only two feet by three and one-half feet of rectangular area. Wall space is often more available than floor space.

A common fallacy is the belief that loudspeaker efficiency at low frequencies requires a large cone. The size of the cone is principally related to power handling capacity. With 32 speakers driven by an average power of three watts, only a fraction of a watt is handled by each unit. A peak power of fifteen watts involves less than a half watt per speaker. Thirty-two is a convenient number for series parallel connection to obtain conventional impedances. The loudspeakers should all be connected in phase.

The phasing of speakers may be checked by applying a low voltage battery to each voice coil in turn and watching the movement of the cone. Each cone should move in the same direction for the same battery polarity.

### General Considerations and Recapitulation

Reproducing middle frequencies is comparatively simple. A fair-sized flat baffle and a 12-inch loudspeaker will produce reasonably satisfactory results. The extreme low frequencies are limited by two factors. The one most commonly understood is the cancellation effect that takes place if the front and rear waveforms from the loudspeaker are not properly isolated. The other problem is the matter of matching the impedance of the loudspeaker to the air, creating an air load that is capable of accepting and transmitting the energy. Where space and cost are of no consequence, this is

most effectively accomplished with a large exponential horn such as is commonly used in theater installations. The Klipsch corner cabinet is another solution that does not require as much space. Corner cabinets of simpler design, bass reflex cabinets, or a combination are the most satisfactory compromises. Large banks of small speaker units may also be used effectively.

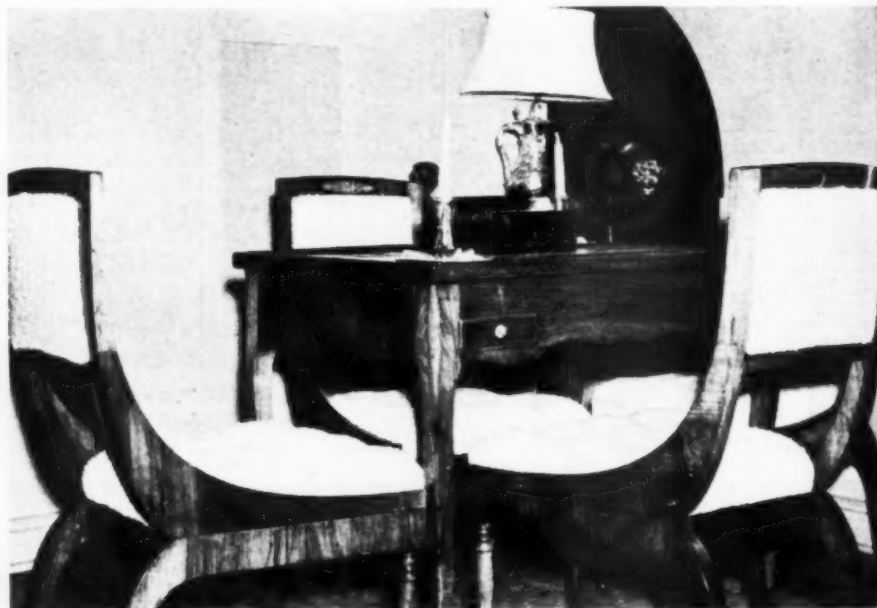
High frequencies are limited by the ability of the cone to respond suitably, which is affected by the mass of the cone structure and other factors. For very wide range systems, it is necessary to use at least two speaker units, one specialized in low-frequency radiation, the other, in high-frequency distribution. High frequencies are also limited by the tendency to beam and by the fact that most wall surfaces absorb the high frequencies and reflect the middle and low frequencies.

There is one other limitation on high-frequency response that is not generally recognized as having importance. This is the fact that high frequencies are absorbed by the air to a greater extent than are sounds in the middle and low range. Under some conditions of humidity and temperature the absorption of high frequencies by the air may be as much as three decibels in fifteen feet. This means, percentage-wise, that the energy will be reduced by half at a distance fifteen feet from the loudspeaker in the region of ten thousand cycles.

Maximum power output from an individual loudspeaker unit is limited not only by the excursion of the cone and the non-linear suspensions and power handling capacity of the voice coil, but also by inherent distortion characteristics of the air. For very high-level operation in quite large or absorptive rooms, it is essential to use more than one radiating unit for optimum results.

-50-

Wall mounted loudspeaker with frame and grill cloth to match wall.





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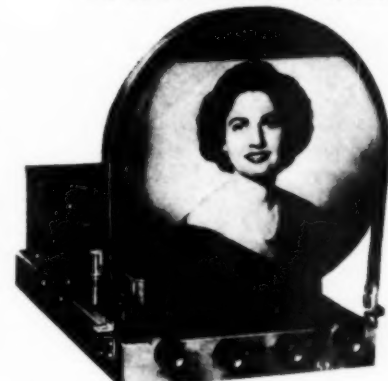
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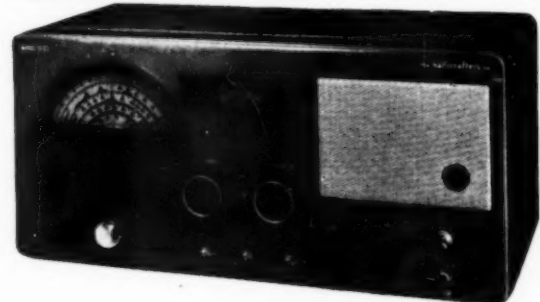
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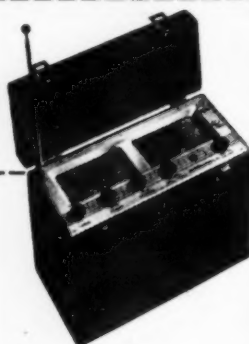
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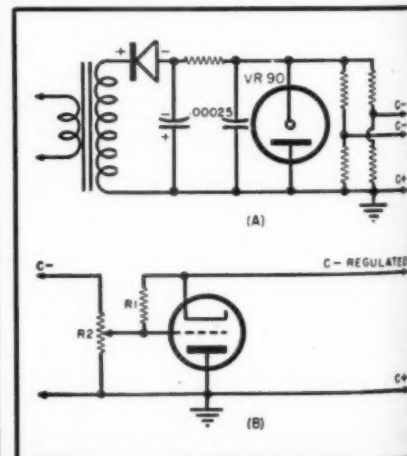
(Continued from page 82)

ulation and lower internal drop in voltage. If the power transformer has the bias tap mentioned previously, the filament transformer connected backward to step up filament voltage to 117 volts will be unnecessary. The bias tap is just as good a source of voltage, although the current rating of the power transformer must not be exceeded.

The second advantage offered by this circuit design is that of tube protection. The usual situation that occurs when a bias rectifier tube is used is that the main power rectifier warms up first and delivers full plate voltage to the output tubes before the cathode-type bias rectifier can deliver bias voltage. The resultant surge of plate current can badly damage tubes and transformers. The usual method for coping with this problem has been to provide a separate switch for the bias supply, so that it may be turned on first, or to provide a time-delay relay so that the main power supply will be able to supply no current until the bias supply is ready. Since a selenium rectifier will go into operation immediately, while any conceivable power rectifier must take a few moments to warm up, these precautions are entirely unnecessary.

It must be remembered, however, that a midget selenium rectifier of the type now used cannot be operated at more than about 130 volts peak back voltage. Therefore, it cannot be used similarly to the 6X5 in the illustrated "side rectifier circuit," which is connected across a high side of the high voltage winding to ground, or it will be destroyed. This circuit features the use of a gaseous voltage regulator tube to give practically ideal stability, filtering, and regulation to the bias voltage. A filter condenser may be substituted for the voltage regulator tube if such good regulation is not needed; this is perfectly permissible.

Fig. 4. (A) Diagram of a selenium rectifier bias supply. The VR-90 tube can be replaced with a filter condenser if desired. (B) Electronically regulated bias supply.





in the bias supply for an amplifier which never draws appreciable grid current. This circuit is the property of the Federal Telephone and Radio Corporation.

Fig. 4B shows a familiar type of electronically regulated power supply adapted to the purpose of bias supply. Any tube of high transconductance, high perveance, and sufficiently low plate resistance is suitable. Tubes of the 2A3 family are good; the 6AS7 and 815 are capable of excellent control of large amounts of current. This circuit is not really necessary on any but high-power rigs, although it is flexible enough for any service of this type. Variations in output voltage are easily accomplished by adjusting  $R_2$  which changes the grid bias on the control tube.

-30-

## ELIMINATING BATTERY TROUBLES

ALMOST every ham who operates mobile has been faced with the problem of a run-down storage battery at some time. Even heavy duty generators and parallel batteries will not help if the operation is carried on with the motor turned off.

A novel method of preventing this occurrence in police cars was shown in the May, 1949, issue of the APCO Bulletin. The system was designed by E. W. Lindfeldt, Chief Radio Techni-

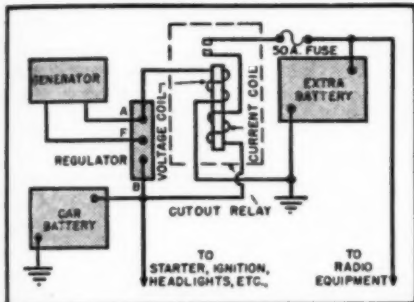


Fig. 1

cian, Police Dept., Sacramento, Calif.

With the system described, the extra battery operates the radio equipment, leaving the regular battery for starting the car, operating the lights, and carrying on its other regular functions. Thus it is possible to operate to your heart's content, subject to the capacity of the extra battery and still have a fully charged battery for starting the car. This feature will be readily appreciated, especially in winter time.

The means used to accomplish this is shown in the schematic diagram (Fig. 1). With the car engine running, the extra battery is automatically connected to the generator through an auxiliary cut-out relay connected to the regular voltage regulator. The extra battery is thus charged along with the regular car battery.

Mr. Lindfeldt has found that a 60-ampere generator is sufficiently large to keep both batteries charged in police work. With the limited operation of most hams, it is probable that the regular car generator will be sufficient. Standard size batteries have been found satisfactory for police work.

-30-

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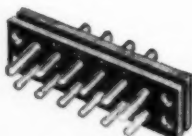
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Connectors for experimental switchboards and testing equipment; 1 to 4 contacts; 75-amp.

## TYPE AP

Seven different insert arrangements same as Type "P" 30 and 15-amp. rating, but with heavier shell, gasketed for weather resistance; coupling nut extraction means; cable clamp plug entries.



## TYPE XK

Same inserts as Type "X"—1, 3 and 4 contacts; for No. 14 and 16 wire; coupling nut extraction means.

## TYPE O

Latchlock sound-microphone series with oval shell; 3 contacts for No. 10 wire, 30 amperes.



**AND 8 OTHER MAJOR TYPE SERIES**—More than 400 radio parts distributors in the USA handle Cannon Plugs... twenty-six representatives located in principal cities are at your service. Or write direct to factory for new C-48 Condensed General Catalog, 32 pages of data and prices.

Cannon Electric also manufactures signal equipment for hospitals, industrial plants, schools, institutions and many other electrical specialties such as conduit fittings, D. C. Solenoids, fire alarm relays, cable terminals, indicator and pilot lights, etc., etc.

Address Cannon Electric Development Co., Division of Cannon Manufacturing Corporation, 3209 Humboldt St., Los Angeles 31, Calif. Canadian offices and plant: Toronto, Ontario. World export: Frazar & Hansen, San Francisco.

**CANNON ELECTRIC**



## The Beginning Amateur

(Continued from page 67)

and its only disadvantage is the need for a very heavy lead to the battery to carry the high-ampere load of the rig. It isn't as bad as it sounds, because it is a simple matter to parallel several lengths of No. 18 or 14 flexible lamp cord to handle even maximum loads with every little voltage drop. Additional wires for the microphone control, and aerial circuits can be installed at the same time. In most cars, these wires must be run under the car and brought up through holes in the trunk and driver's compartments. They must be very well protected because they will take a terrific beating from gravel, rain, mud, ice, and so on. The flexible armored cable commonly used for house wiring ("BX") is cheap and very good for this purpose.

One-handed push-to-talk operation is a "must" for mobile work. You can't juggle switches and a mike and expect to keep the car on the road at the same time.

Plate supply for the transmitter is much more of a problem than the transmitter itself. The r.f. and modulator elements of a mobile rig are no different from those of a fixed trans-

mitter. The trick is to change six volts to several hundred volts. For transmitters of more than a couple of watts, there is no choice but a dynamotor, a rotating machine with two armature windings and one field winding.

Current from the car's battery, led into one winding through brushes and a commutator and also to the fixed field winding, makes the machine run as a motor. The other winding, being twirled past the magnetic field of the fixed winding, develops voltage of its own; this is led out from another set of brushes and a commutator at the other end of the shaft. Dynamotors are noted for their dependability and long life. They are far superior to vibrator power supplies for the relatively heavy current demands of transmitters. Some fine ones for mobile rigs are available as military surplus at very low prices.

Factory-made converters and transmitters for mobile operation are rather limited in number at the present time, but with the growth of interest in this activity, manufacturers are beginning to become aware of the possibilities of these units.

Whether you make your own or buy it ready made, a mobile rig is lots of fun. Try it once and you'll be convinced!

(To be continued)

## CARBON-TET AIDS COIL WINDING

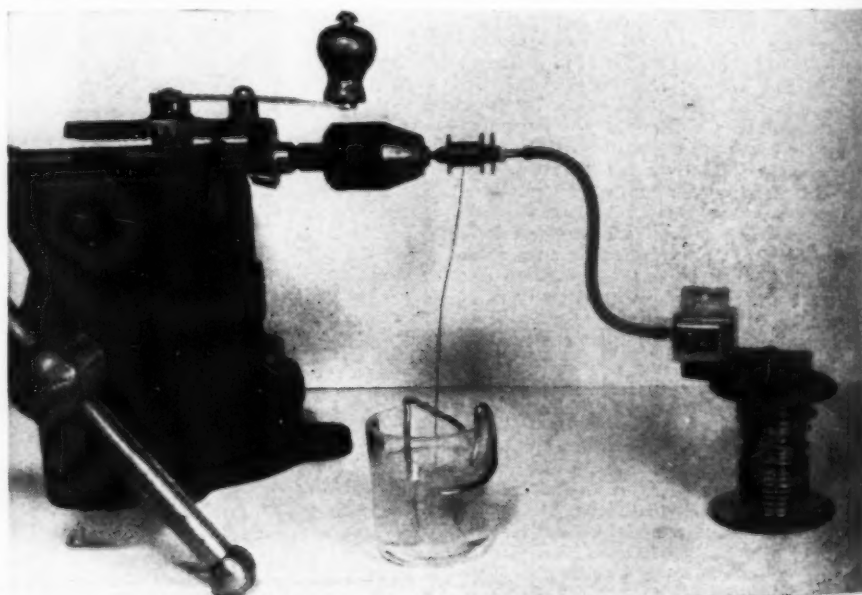
**THE EFFICACY** of carbon tetrachloride in removing wax coating was shown recently when it was necessary to use a certain type of wire for a coil winding job.

In winding a series of experimental high-impedance tape recording heads, the only suitable wire available for the audio coils was the fine wire in the transformer from which the pole-piece laminations were obtained. Thoroughly impregnated with wax, the wire broke frequently during the winding.

A prolonged soaking in carbon-tet had merely cleared the wax from the first outside layers.

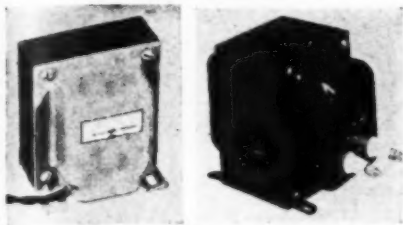
Suspending the wire bobbin in a small glass of carbon-tet solved the problem, since the wax was dissolved as the winding progressed and thousands of turns were wound without a single unintentional break. For recording turns, a surplus counter was coupled to the coil form by a short length of rubber tubing . . . . . A.C.P.

Immersing the wire in carbon tetrachloride before winding will remove unwanted wax.





## NEW TRANSFORMERS And CHOKES



### ALL FOLLOWING TRANSFORMERS 115 V.A.C. 60 CYCLE INPUT:

OUTPUT: 750-0-750 V.A.C. (600 V.D.C. after choke input filter at 250 MA.) Includes 6.3 V.A.C. winding at 5 amps and 5.0 V.A.C. winding at 4 amps. NH-106.....\$7.95

OUTPUT: 625-0-625 V.A.C. (500 V.D.C. after choke input filter at 250 MA.) Includes 6.3 V.A.C. winding at 5 amps and 5.0 V.A.C. winding at 4 amps. NH-107.....\$7.35

OUTPUT: 600-0-600 V.A.C. at 250 MA. 12 V.A.C. at 3 amps; 12 V.A.C. at 3 amps and 5 V.A.C. at 3 amps. Designed for Army surplus transmitters. NH-108.....\$6.90

OUTPUT: 250-0-250 V.A.C. at 60 MA. 24 V.A.C. at .6 amps; 6.3 V.A.C. at .6 amps. Designed for Army surplus Receiver. NH-109.....\$3.00

OUTPUT: 6.3 V.A.C. at 6 amps. NH-110.....\$2.25

OUTPUT: 24 V.A.C. at 2 amps. NH-111.....\$2.25

OUTPUT: 2.5 V.A.C. at 10 amps, center tapped and shielded. Open frame mounting insulated for continuous operation at 5,000 volts. NH-113.....\$4.20

(ALL TRANSFORMERS ARE CASED)

### CHOKES:

NH-115—8 Henries at 500 MA. filter choke, 5,000 volt insulation.....\$9.95

NH-116—5-20 Henry 500 MA. swinging choke, 5,000 volt insulation.....\$9.95

NH-117—8 Henries at 700 MA. filter choke, 7,500 volt insulation.....\$14.95

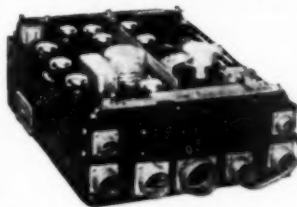
NH-118—5-20 Henries at 700 MA. swinging choke, 7,500 volt insulation.....\$14.95

NH-121—15 Henries at 250 MA. filter choke, 1,500 volt insulation.....\$4.95

(ALL CHOKES ARE CASED)

ALL ABOVE ITEMS BRAND NEW—NOT SURPLUS!

## BC-645-A TRANSCEIVER For Citizens Band



• 15 Tube Transceiver ideal for conversion to 460 MC. Citizens Band. Frequency coverage 435 to 500 MC. Complete conversion instructions for Citizens Band furnished. Price, NEW and BOXED.....\$16.95

DYNAMOTOR PE-101 for BC-645-A—13 or 26 volt input; required voltage output.....\$2.95

TRANSFORMER for BC-645-A—110 volt 60 cycle input; output 400 volt 150 MA after filter, 12, 9, and 6 V. AC, 4 amps, and 5 V. 3 amps. No. NH-645.....\$6.95

CHOKE—15 Hy. 150 MA. No. NH-646.....\$2.95

### TRANSFORMERS—110 Volt

#### 60 Cycle Primaries:

Sec. 12 V. 1 amp.....\$1.50

Sec. 24 V. 1 amp.....1.95

Sec. 24 V. 2 amps.....2.25

Sec. 24 V. 5 amp.....1.50

Sec. 36 VAC. 2.5 amps.....2.95

Sec. 14-14 or 28 V. 7 1/2 or 15 amps.....4.95



No. DM-680—Price.....\$7.95

DYNAMOTOR—9 VDC input; output 450 V. 60 MA. 6VDC input; output 275 V. 50 MA. with Blower.

No. DM-9450—Price.....\$3.95

### DYNAMOTORS AND INVERTERS:

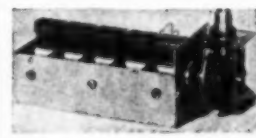
Write today telling us your requirements—or send for list of stock available of the following numbers: DM—20-32-33-40-42; PE—73-94-98; BD—77-86-93; PE—206-218-115; MG—149-149F-153-153F; D—401-402-104, etc.

### SELSYN TRANSMITTER AND INDICATOR SYSTEM

Ideal as radio beam position indicator for Ham, Television, or Commercial use. Complete with 5 inch I-82 Indicator, Autosyn Trans., 12 Volt 60 cycle Transformer, and wiring instructions.

Prices: NEW.....\$9.95 USED.....\$7.95

PL-118 PLUG.....\$1.00 Autosyn Trans. ....\$2.95



### CONDENSER ASS'Y.

5 GANG with vernier tuning. 25 MMFD. to 450 MMFD. each section. Size: 7 1/2" x 3 1/2" x 1 1/2". Price.....\$2.95

CONDENSER—3 Gang. 25 MMFD. to 450 MMFD. each section. Size: 6" x 3 1/2" x 1 1/2". Price.....\$1.95

### BC-223 TRANSMITTER

50 Watt Transmitter with crystal oscillator control on four pre-selected channels—also master oscillator. Frequency coverage 2000 KC. to 5250 KC. by use of three plug in coils. Five tube operation. 801 oscillator. 801 power amplifier, two 46 modulators, and one 46 speech amplifier. Price with TU-17 Tuning Unit, 2000 to 3000 KC. and cable from transmitter to dynamotor.



Prices: NEW.....\$24.95 USED.....\$19.95

### ADDITIONAL TUNING UNITS: NEW: USED:

TU-17 2000 to 3000 KC. ....\$3.50 \$2.50

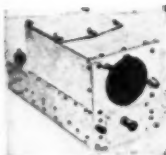
TU-18 3000 to 4500 KC. ....3.50 2.50

TU-25 4500 to 5250 KC. ....3.50 2.50

CABLE only for Transmitter to Power Supply for BC-223 Transmitter. Price.....\$1.75

PE-125 POWER SUPPLY for BC-223 Transmitter. Operates from 12 or 24 Volts and supplies 500 volts at 150 MA. Prices: NEW.....\$9.95 USED.....\$7.95

## COMMAND RECEIVERS—TRANSMITTERS—And Accessories:



BC-453 Receiver 190-550 KC. ....\$12.95

BC-455 Receiver 6-9.1 MC. ....7.95

BC-454 Receiver 3-6 MC. ....6.95

DUAL or TRIPLE RECEIVER RACK.....1.95

BC-450 Triple Con. BOX.....1.95

TRANSFORMER—F/Comm. Rec. —110 V. 60 cycle input; output 250-0-250 VAC. 60 MA.; 24 VAC. .6 A. & 6.3 VAC. .6 A.

No. NH-109.....NEW: \$3.00

DYNAMOTOR—Can be used on 6 VDC. to supply 240 V. 50 MA. f/Comm. Rec. Mobile operation. USA/0515.....2.95

SELSYN SIZE V—No. C-78248—110 Volt AC. 60 cycle. Can be used to turn small antennas or for position indicator systems. Size 3 1/2" x 5 1/2". Price per Pair.....\$5.95

SELSYN 2JIGI—WITH CAPS—Can be used as position indicator for antennas. 110 Volt 60 cycle. Instructions furnished. Normally operates from 57.5 V. 400 cycle. Price per Pair: \$3.00. Price—Caps only.....50c Ea.

### WHIP ANTENNA EQUIPMENT



MP-22 MAST BASE—(Ill.) mounting with spring action and 4" x 6" mounting bracket. Insulated at top to receive mast sections listed below.

Price.....\$2.95

MP-47 MAST BASE—has heavy coil spring and large base insulator, used with BC-610 Transmitters, etc.....\$6.95

MP-48 MAST BASE—has heavy coil spring and insulated at top, requires 1 1/2" mounting hole. Price.....\$2.95

MP-37 MAST BASE—has heavy coil spring and 8" insulator at bottom, requires 2" mounting hole.....\$3.95

MP-57 MAST BASE—same as MP-37 but has 5" insulator.....\$3.95

MP-132 MAST BASE—has 1" dia. heavy coil spring, 2" insulator at bottom. Requires 1" mounting hole. Overall base length 11 1/2". Price.....\$3.95

### MAST SECTIONS FOR ABOVE BASES:

Tubular steel, copper coated, painted, 3 foot sections, screw-in type. MS-53 can be used to make any length, with MS-52-51-50-49 for taper. Price—any section.....50c Ea.

FL-8A FILTER—1200 CPS.....\$1.95

BLOWER—110 Volt 60 Cycle, 4" intake, 2" outlet. Approx. 100 cu. ft. dis. Motor size: 3" x 3". 1750 RPM.

Prices: NEW.....\$6.95

Motor only.....3.95

### MISCELLANEOUS:

Cable f/BC-375 w/PL-59 ea. end.....\$1.75

Cable f/BC-375 w/PL-61 ea. end.....1.75

Cable f/BC-375 w/PL-64 ea. end.....1.75

Tuning Unit f/BC-375 TU-6-8-10-20.....Each 3.95

FT-131 Mounting f/BC-375-191.....1.50

GN-45 Generator.....5.00

Leg & Seat Assy. f/hand generators.....2.75

Crank for hand generators.....Each .75

BC-357 Marker Beacon (used).....2.95

BC-301 Marker Beacon, less tube.....1.95

BC-347 Amplifier, Used, less tube......75

RG-8U Coaxial Cable.....Per Ft. .05

Cable—4 Conductor, shielded, 50 Ft. length.....2.00

Coaxial Cable—125 OHM cotton covered, 50 Ft.....1.00

HS-17 Head Phone & Chest Set used w/EE-8 for extensions.....2.95

HS-33 Headset, Low imp. (used).....1.25

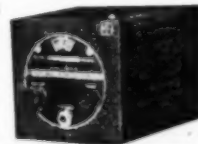
TN-13 Handset.....3.95

T-17 Microphone.....USED: 99c; NEW 1.49

T-30 Throat Mic. Used.....6 for 1.00

### BC-1206 RECEIVER SETCHELL-CARLSON

200-400 KC. 5 Tubes.  
Operates from 24-28 Volt  
DC. 1F Freq. 135 KC.  
Size: 4" x 4" x 6".  
Price: LN.....\$7.95



FT-237 MOUNTING BASE f/BC-604 & 603's, & f/BC-684 & 683's.  
Prices: NEW \$2.95; USED.....\$7.00

INVITATION—IF YOU ARE NEAR LIMA, STOP IN TO SEE OUR LARGE VARIETY OF SURPLUS RADIO EQUIPMENT AVAILABLE IN OUR BRAND NEW SALES ROOM!

## Limited Supply . . . MARK II B19 Transmitter and Receiver 15-Tube Sets

2-8 MC., 240 MC., AND INTERCOMMUNICATING IDEAL FOR MOBILE AND STATIONARY USE!



Set Transmits and Receives 2 to 8 MC. Phone, CW and MCW 25 Watt Master Oscillator Control. Transmits and Receives 240 MC Phone. Also Intercommunicating Set. Complete with 15 Tubes, Headset, Micro, Antennas, Control Box, 12/24 Volt Power Supply, and Instructions. Ready to operate. Set size: 27" x 10" x 13 1/4"

Prices: NEW \$59.50; USED (Tested).....\$39.50

Also Available—All Parts and Accessories for B19 Mark II Sets!

Address DEPT. RN • Minimum Order \$2.00 • Prices F.O.B., Lima • 25% Deposit on C.O.D. Orders

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## What's New in Radio

(Continued from page 97)

F-222 West Fourth St., Covington, Ky.

Although it is primarily built for prospecting, the "Keleket" Model K-802 may be connected to a p.a. system for classroom use. Two flashlight batteries operate the unit through the



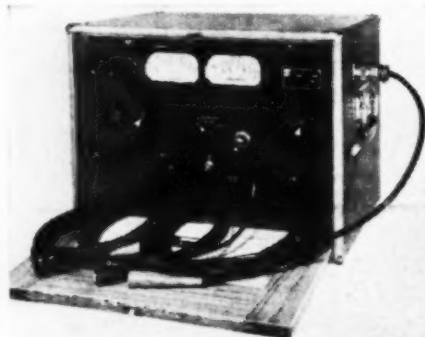
power supply that furnishes high voltage for the Geiger tube. No separate probe is necessary with the unit.

As it responds to both beta and gamma rays, this locator is especially suitable for uranium prospectors, as that particular material often emits both beta and gamma radiation. Lightweight and durable, the plastic case may be carried in the hand, hooked on the belt, or even in the pocket.

## INSULATION TESTER

Speed in operation with complete safety are features of the portable insulation tester designed by the Radio Frequency Laboratories, Inc., Boonton, New Jersey. It provides complete facilities for taking insulation resistance and dielectric absorption measurements on cables, transformers, rotating machinery, condensers, etc.

A constant voltage transformer reg-



ulates voltage to within one-half of 1% on this RFL Model 184C, which has four voltage ranges with continuously variable d.c. voltages up to 10 kv. It operates from a 115 v. 60 cycle line and consumes a maximum of 65 w.

Resistance of .1 to 50,000 megohms may be read directly on a megohmmeter scale at open circuit voltages of .5, 1, 5, and 10 kv. They may also be calculated in ranges of .3 to 20,000 megohms from a voltmeter and microammeter connected to read resistance at any desired test voltage operating from

## "America's Best Buy"

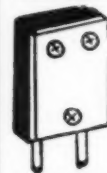
RADIO TUBES—34c each  
100 for \$29.95

GT type. Cartoned and guaranteed.				
1R5	12BE6	12AU6	6SU7	12S8
1T4	12AT6	12BF6	6AQ5	6BH6
1U5	35W4	6BA6	6AQ6	117Z3
3A4	35B5	6BE6	6CA	19T8
155	50B5	6AT6	6X4	6BJ6
3V4	12AT7	6AL5	6W4	6BA7
3Q4	12AU7	6AQ5	6AG5	6BJ6
35A	12AX7	6BF6	6AU6	35C5
12BA6	12BA7	6AU7	6BG6	31

4" or 5" P.M. Speakers—A BUY . . . 99c each  
300-Ohm Twin-Lead . . . 100-foot roll \$1.95  
Phono-motor with turntable AC 78 rpm . . . \$1.75  
Phono-motor spring wound with crank . . . \$1.75  
Phono amplifier with tube . . . \$2.49  
4-prong standard vibrator \$1.29 each; 10 for \$11.90  
Top owl ear antenna less lead-in 3 section 89c ea.  
Blank replacement  
cabinets . . . No. 1—\$1.40; No. 2 \$1.75  
No. 3—\$2.25; No. 2 center speaker grill . . . \$1.75  
Crystal calibrator 98c, this CFI gives a 50 KC  
beat note, see Jan 49 CQ, less tubes and crystal.  
Only . . . 98c

## CRYSTALS 98c each

Your frequency plus or minus 10KC



80	Meter, 3500-4000KC
40	Meter, 7000-7300KC
	for multiplying into
20	Meter, 7300-7425KC
10	Meter, 7300-7425KC
2½	Meter, 8000-8222KC

200 QSL CARDS . . . \$2.25  
Neatly printed in black with your name, address  
and call letters. Two-color QSL's \$3.50 for 200.  
Postpaid.

Postage extra 20% deposit on C.O.D.

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1314 McGee St., Kansas City 6, Mo.

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Radio Equipment

Type AN/TRC-1, -2, -3, and -4  
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R19 Receivers  
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AM8 Amplifiers  
PP13 Power Supplies

Type 1498 and 1505 Equipments

1498-T Transmitters  
1498-R Receivers  
1498-P Power Supplies  
1504 Remote Control Units  
1505-A Power Amplifiers  
1505-P Power Supplies

Any quantity and condition

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RADIO & TELEVISION NEWS

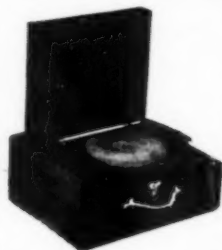
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RADIO & TELEVISION NEWS



# OUTSTANDING VALUES NOW AVAILABLE

## 3-SPEED PHONOGRAPH



Plays 33 1/3 RPM, 45 RPM, 78 RPM, Records. Single Arm Operation. This fine record player comes with an Astatic three-play arm, a Alliance 3-speed motor, 3 tube amplifier, 5" Speaker. Built in an attractive, sturdy carrying case. Fine parts and construction give large set performance.

Only \$18.95

Lots of three—\$18.29 each

Single speed 78 RPM Phonograph in same case.....\$15.49

Single speed 33 1/3 RPM Phonograph in same case.....\$15.49

## SUPER 25 WATT HI-FI AMPLIFIER KIT



Including all parts, schematic and layout diagrams, enabling you to easily build this fine, deluxe amplifier.

### FEATURES:

- Ready punched chassis
- Multi-impedance output transformer 2-4-8-16-500 ohms for use with any PM speaker
- 2 mike inputs, 1 phono input
- Push pull phase inverter driver for low hum and distortion
- Hum level 65 DB below rated output
- Separate bass and treble control
- 110-120 volt AC operation, on fuse UL approved line cord
- 6 tubes: 2—6SJ7, 6SC7, 2—6L6G, 5Y3
- Attractive, well-constructed steel chassis and cover. Baked hammerloid finish
- Indirect lighted panel
- Frequency Response 20-17000

Nowhere can an amplifier of comparable features be had for twice the price. This amplifier, designed from the famous Clark Amplifier, will fill 90% of all sound uses.

**\$24.95** COMPLETE WITH TUBES

## CLARK 15 WATT AMPLIFIER KIT



Another popular Clark kit. All first line parts to make an exceptionally fine unit.

- 6 tubes—2—6SQ7, 2—6V6, 1—6SN7, 1—5Y3GT. • Mike and phono input • Separate treble and bass controls. • Heavy steel chassis and cover. • Frequency response 30-17000 CPS+1DB. • Output impedances 4-8-16-500. • Hum level 65 DB below rated output.

**\$18.95**

## MOTOROLA MODEL VT-71

New—Standard Guarantee—with fine tuning knob. Attractive Mahogany cabinet. Reception on all 13 channels. Can be used with an indoor antenna in good signal areas. Compact. Table model. 7" tube. Size 9 1/4"x16 1/2". Weight 26 1/2 lbs. Formerly \$189.95

NOW ONLY \$92.50

(plus \$1.50 excise tax.)

## 150 WATT SOLDERING IRON



3/8" plug-in type tip. Removed by set screw. Perfect for general soldering work. Handle stays cool. UL approved cord. Price...\$2.29

## 10 WATT AMPLIFIER SYSTEM

An amazing value! including: •10 watt high quality amplifier. Tubes: 6L6, 5Y3, 6SL7. Mike and phono input. Attractive maroon and grey, all-steel cabinet. •Hi-Gain crystal mike with table stand. •Attractive heavy-duty carrying case. •Heavy Alnico V. 12" P.M. speaker, with matching transformer.



This amplifier system is just the thing for all medium and small gatherings. It gives excellent performance on music and speech.

Only \$29.95 Complete

- 12" PM Heavy Alnico V Magnet.....\$4.59
- Crystal Mike with Switch and Stand. 15 feet of Mike cable.....\$5.95
- 10 Watt Amplifier Only.....\$15.49

## P.M. SPEAKERS

All Alnico V—All First Line Speakers.

### FULLY GUARANTEED

- 3" P.M. Square Frame.....\$0.79
- 4" P.M. Square Frame......95
- 5" P.M. Round Frame......95
- 6" P.M. Round Frame..... 1.39
- 6" P.M. Pin Cushion Frame..... 1.49
- 7" P.M. For Auto Replacement.... 2.49
- 8" P.M. Round Frame..... 2.29
- 10" P.M. Round Frame..... 3.49
- 12" P.M. Round Frame..... 4.59

## RADIO PARTS COMPANY CLOSE OUT VALUES AT GREAT SAVINGS TO YOU

Cut out handy order form, place quantity in front of item desired, mail to us.

We shall give your order our prompt attention.

- ICA 96" side cowl antenna—Chrome finish, all mounting hardware, insulators, and lead in. Each \$1.29 10 for \$11.90
- 6" 450 ohm Dynamic Speakers.....Each \$1.49
- Permatlux 12" PM.....Each \$3.79
- Line cord—Molded Rubber Plug. Each 15c.....10 for \$1.29
- Push back wire—Solid and Stranded No. 20. 100 ft. Hanks.....\$0.59 500 ft. Roll..... 2.49 1000 ft. Roll..... 4.49
- Presto 16" Professional Recording Discs—Metal Base. Each 99c—10 for \$8.90
- 6" PM Speaker 1 oz. Alnico V.....Each \$1.19
- Single Conductor Shielded Mike Cable.....50 ft. \$1.75
- Universal 8 Watt Output Transformer—3/4" Strap type mounting......49
- Appliance Cord, 3000 cycle, UL Approved. 100 ft. roll.....\$1.98
- Record Carrying Case—Attractive—Well Built—Covered in Crown Leatherette and Alligator Leatherette. 25 Record case \$1.29 50 Record case 1.89
- Bakelite Plug in Coil Forms. 4 Prong 3" Length 5 Prong 2 1/4" Length 4 Prong 2 1/4" Length 6 Prong 2 1/4" Length Each 19c—10 for \$1.50
- 2-tube Phono Oscillator—Using 12SN7 and 6U5—Complete with tubes \$3.19
- VM Dual Speed Changers—In Original cartons: Model 800-D3.....\$19.17 Model 801-D—with base..... 21.25
- Bat Handle Switches—1 3/4x 3/4 Mount Plate—Screw Terminals H & H 5A—125V. SPST 25c DPDT 32c

QUANTITIES ARE LIMITED—ORDER NOW!!

**Radio Parts Company, 614 RANDOLPH ST., CHICAGO 6, ILL.**





## Easy on the Ears...

### TELEX Monoset\*—Under Chin Headset

Stethoscope design of the Telex *Monoset* eliminates tiresome pressure—instrument swings lightly under the chin. Wear it for hours without fatigue!

### TELEX Earset\*—Slips onto the Ear

Weighing only  $\frac{1}{2}$  oz., *Earset's* flat plastic frame slips onto the ear, holds the sensitive receiver securely in place. User's other ear is always free for phone calls or conversation.



### TELEX Twinset\*—Nothing Need Touch Ears!

Lightest twin-receiver headset made—weighs only 1.6 oz. Adjust to any head. Flexible, slips into pocket.

### TELEX Pillow Speaker

permits private radio listening. Palm-sized, weight 1.1 oz., shockproof, sterilizable.

Write for Colorful FREE Specifications Folder Today!

# TELEX

DEPT. F-20-11, TELEX PARK  
MINNEAPOLIS, MINNESOTA

In Canada, Atlas Radio Corp., Toronto



zero volts to 10 kv. The alternate method may be selected by means of one switch, and brass handles on the unit facilitate handling in the field.

### CIRCUIT TESTER

All low resistance circuits of 50 ohms and under may be checked instantly by means of a small tester that fits into the pocket and is called the "Cord Visual Circuit Tester." The device has been introduced by the *Gits Molding Corporation*, 4600 W. Huron St., Chicago 44, Ill., and is the result of a war-time development used by inspectors.

With this unit the electrician, repair man, or amateur can tell immediately whether the circuit is open or closed on such appliances as pilot lights, fuses, flash bulbs, radio tube elements,



speaker voice coils, transformer and coil windings, and so forth. The tester utilizes penlite battery cells and is so small as to resemble a flashlight. A test prod about one inch long is fastened next to a tiny bulb, so that when the prod is applied to the circuit, the bulb lights up to indicate "good."

### NUCLEONIC MODEL RD-1A

A comparatively low-cost, completely portable radiation detector operated with standard radio batteries has been introduced by the *Nucleonic Corporation of America*, 499 Union St., Brooklyn 31, N. Y.

Presence of radiation is indicated by means of clicks or by the rate of light flashes of a neon bulb. Small in size,  $2\frac{3}{4}$  by  $4\frac{1}{2}$  by  $5\frac{3}{4}$  inches, and weighing only 2 pounds, the instrument may be clipped onto the belt for greater freedom.

Extreme sensitivity of the *NCA* radiation detector and its simplicity



make it especially suitable for prospectors of uranium or other radioactive substances.

### TELEVISION CLARIFIER

*Precision Electronics, Inc.*, 643 Milwaukee Ave., Chicago 22, Ill., has recently announced that they are producing a TV Clarifier to eliminate her-

## NEW PRECISION ELECTRONICS MUSIC AMPLIFIER

the undisputed "Best" or your money refunded



Performance limited only by your input and output components. For any magnetic or crystal pickup, radio, or microphone. Multiple impedance to match any speaker.

Write for literature and name of your nearest Jobber.

PRECISION ELECTRONICS, Inc.  
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SPECIALISTS IN SOUND...

NOW... quickly, easily  
cut SQUARE and  
OBLONG openings  
in radio chassis



WITH THE GREENLEE No. 731  
SQUARE RADIO CHASSIS PUNCH

Now, in  $1\frac{1}{2}$  minutes or less you can do hole-cutting jobs that might take an hour with old "drilling and filing" methods. Simply insert GREENLEE Punch and turn with an ordinary wrench... a square or oblong opening is cut immediately. An indispensable, timesaving tool that pays for itself in a hurry.

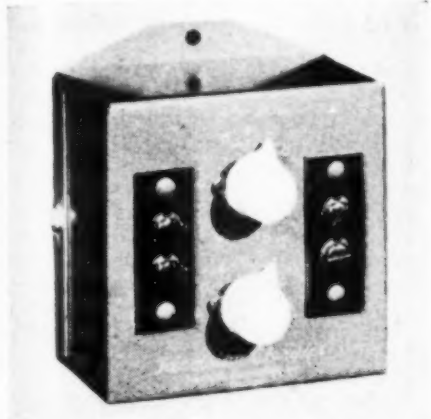


Write today for facts and prices on this handy Punch. Greenlee Tool Co., 1891 Columbia Ave., Rockford, Ill.



ringbone patterns, tears, waves, and other picture effects and distortions produced by FM, amateurs, short-wave, or electrical apparatus.

In addition to those applications, the



Clarifier is effective when installed between a.c. outlets and receivers as a trap for interference.

The device consists of two variable condensers in parallel with fixed inductance and is inserted between the antenna and receiver.

#### VOLTOHMMETER KIT

One of the newer products developed by the *Heath Company*, of Benton Harbor, Michigan, is a "Handitester Kit" with a 3-inch built-in meter that operates on a.c. or d.c., having ranges of 10, 30, 300, 1000, and 5000 volts. Ohm ranges are 0 to 3000 and 300,000, while the milliampere ranges cover 10 ma. and 100 ma.

Parts are housed in a pocket-size



bakelite case, in which the 400 micro-ampere meter movement is already mounted.

#### PRECISION POTS

A culmination of nearly two years of laboratory research and experiment is the line of precision linear potentiometers, models "F" and "G" being produced by the *Helipot Corp.*, 916 Meridian Ave., South Pasadena, Calif.

These instruments are single-turn pots with continuous rotation; the smaller of the two models is adapted for transmitting and aircraft applications, while the larger is designed and

# THE ONLY ONE OF ITS KIND

## FOR PERFORMANCE!

## IN VALUE!

## FOR CONVENIENCE!

### Another great UNIVERSITY FIRST!

- HANDLES 30W CONTINUOUS INTEGRATED PROGRAM MATERIAL

- EASILY ACCESSIBLE, ALWAYS VISIBLE TERMINAL BLOCK

- TAPS MARKED IN BOTH IMPEDANCE AND WATTS

- SHATTERPROOF BAKELITE BODY, ENDURINGLY BEAUTIFUL

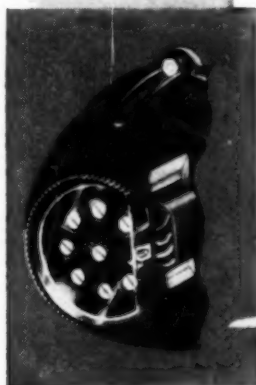
- SUPER-EFFICIENT "W" SHAPED ALNICO 5 MAGNET



# University

MODEL PA-30

## DRIVER UNIT



— plus BUILT-IN, MULTI-TAP LINE MATCHING TRANSFORMER

These rugged drivers represent the first high power continuous duty, completely waterproof units available with built-in line matching transformers. New type W-shaped Alnico 5 magnets result in the elimination of stray fields and a greater concentration of magnetic energy in the voice coil gap. Exclusive UNIVERSITY "rim centering" assures perfect alignment and concentricity — always. Units may be used with equal facility on constant voltage and constant impedance output systems. Transformer and voice coil terminals are brought out at the bottom of the unit to a terminal block which is an integral part of the molded housing. A translucent cover plate provides ready access to the 16, 165, 250, 500, 1000, 2000 ohm terminals and their equivalent wattages based on 70 volt line.

WRITE DEPT. N FOR ILLUSTRATED CATALOG



# University

## LOUDSPEAKERS, INC

80 SO. KENSICO AVE., WHITE PLAINS, N. Y.

Famous World-Wide for LOUDSPEAKERS • DRIVER UNITS • TWEETERS • PORTABLE POWRMikes



deliveries  
are now  
being made

the  
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**ALTEC**

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MICROPHONE**

**EXCLUSIVE  
FEATURES:**

- New tonal fidelity
- Full volume range
- Omnidirectional
- No false bass



ACTUAL  
SIZE

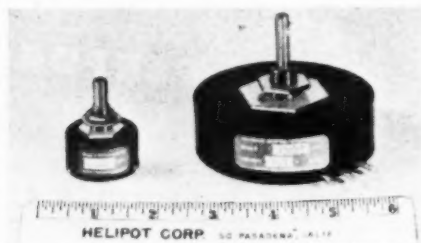
Talent deserves  
to be SEEN as well  
as HEARD

**ALTEC**  
LANSING CORPORATION

161 Sixth Avenue, New York 13, N.Y.  
1161 North Vine St., Hollywood 38, Calif.

engineered for various computer systems.

Models "F" and "G" will be available



able in the standard forms or they can be custom-built on special order in any version to which they are applicable.

• • •

**CURRENT INDICATOR**

A miniature device for service technicians that will indicate load current of motors and other a.c. operated electrical devices has been introduced by Industrial Devices, Inc., Edgewater, New Jersey.

This unit, called the Mini-Amp, is less than 2 by 2 by 1 inch thick and has an opening in the center through which pass the current-carrying lines. Accuracy is held within 5% and does not depend on the kind of insulation, line voltage, or manner in which wire turns are made through the center.

-30-

**Intercom For The Home**

(Continued from page 51)

in the open was used in this setup, which has a 30-foot cable run from the basement master to the upstairs master.

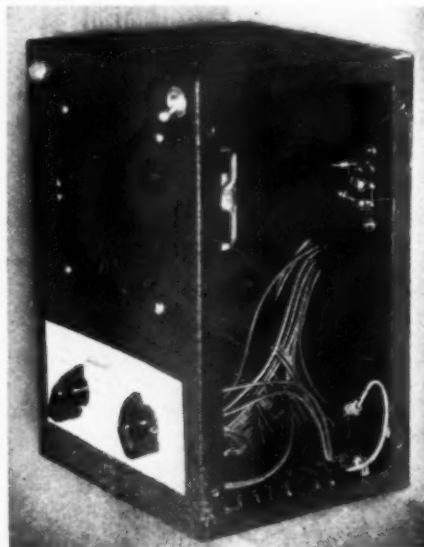
Reversing the input transformer primary leads and changing the placement of the amplifier input and output ground returns in the kitchen box should clear up any difficulties. Shielded "In" and "Out" leads may be

utilized, if desired, and should be used for longer cable runs. In such a case the shields can be used for the ground lead, "G."

The cellarway is the most logical place to run the cables; therefore, the locations of the amplifier and kitchen box should be chosen with this in mind. The cable run from the kitchen box to the upstairs hall box presents the real problem. In this installation, the cable goes from the kitchen box up through the cellarway ceiling. It comes through on the second-floor stairway landing, which is one step below second-floor level. Then it goes behind the floor shoes for six feet and comes up between the wall separating the hall and bathroom.

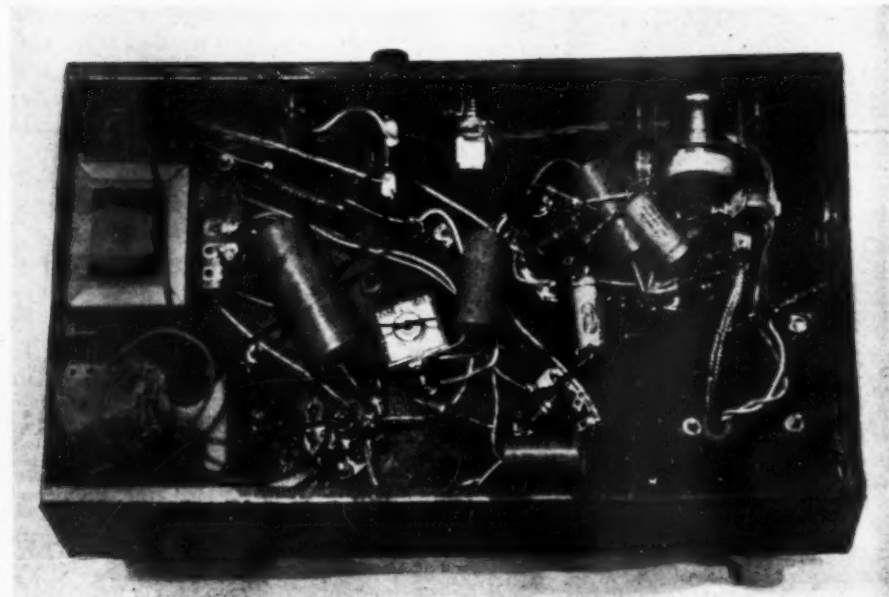
This intercom has given four years of excellent service. The reader should have no difficulty in bringing the convenience of this intercom system into his home.

-30-



Kitchen master unit with the side panel removed to show terminal strip mounting.

Under-chassis view of amplifier showing parts arrangement and wiring.







# MORE TUBES—LOWER PRICES!

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STANDARD BRAND

Type	Price	Type	Price
1B22	4.95	12KP4	49.50
1B23	9.50	12LP4	49.50
1B24	4.95	15E	1.50
1B25A	4.95	15R	.98
1B26	7.95	23D	.98
1B27	4.95	24G	.98
1B29	.89	35T	4.95
1B32	4.95	45SPEC.	.49
1B38	49.50	53A	24.95
1B40	4.95	75TL	8.95
1B59	12.95	100TH	12.95
1B60	4.95	100TS	3.00
1N21	1.00	101F	4.95
1N23	1.00	114A	.69
1P23	1.95	124B	1.25
2AP1	3.95	130	5.95
2C4	1.18	121A	2.65
2C21	.98	203A	16.95
2C22	.39	205B	4.50
2C26A	.28	205F	4.50
2C34	.59	211	3.00
2C40	3.95	215A	3.00
2C43	9.50	218	49.50
2C44	1.75	221A	2.95
2C46	7.50	231D	1.49
2C51	1.18	239C	3.49
2D21	1.18	250B	1.95
2E22	1.50	250TH	19.50
2E24	4.95	252A	4.95
2E25A	4.25	259A	4.95
2E26	3.95	262A/B	3.50
2E30	3.95	274B	1.25
2F21A	12.95	275A	.95
2F26	8.95	282A/B	9.95
2F27	14.95	283A	10.95
2F30	19.95	286A	10.95
2F31	19.95	290A	4.95
2F32	2.95	291A	4.95
2F33	24.95	294A	4.95
2F36	75.00	300A	3.95
2F37	24.95	301A	6.95
2F38	24.95	304B	5.95
2F49	24.95	309A	6.95
2F51	4.95	304TL	9.49
2F54B	24.95	307A	4.95
2K23	24.95	310A	7.95
2K25	24.95	315A	6.95
2K28	24.95	316A	.69
3AP1	24.95	327A	4.95
3B22	4.95	338A	4.95
3B23	4.95	348A	5.95
3B24	1.98	350A/B	2.95
3B24W	2.95	354C/D	19.95
3B26	1.89	357B	49.50
3B28	1.89	360A	4.95
3BP1	3.95	371A/B	.89
3C23	4.95	374A	2.50
3C24	.69	393A	7.95
3C30	1.50	394A	7.50
3C31	4.95	396A	3.25
3CP1	3.00	400A	1.95
3DP1-A	3.95	401A	1.95
3EP1	3.95	403A/B	1.75
3EP2	4.95	417A	24.95
3FP7	3.95	434A	7.95
3GP1	4.95	436A/B	2.95
3JP7	7.95	450TH	24.95
4-65A	14.50	450TL	45.00
4-125A	27.50	464A	9.50
4-250A	37.50	527	12.95
4A1	.98	531	24.50
4AP10	1.95	531P	4.95
4C35	19.95	631P1	4.95
4J26	110.00	700B/D	49.50
5AP1	4.95	701A	4.95
5AP4	4.95	703A	4.95
5BP1	2.95	705A	2.95
5BP4	4.95	706A	4.95
5C22	49.50	706CY	18.95
5CP1	3.95	706GY	49.50
5CP1A	9.95	707A/B	24.95
5D21	29.95	708A	7.95
5FP7	3.95	710A	2.95
5GP1	2.95	713A	1.95
5HP4	9.95	714AY	6.95
5J23	100.00	715A/B	9.95
5J29	100.00	715C	24.95
5LP1	11.95	717A	.99
5MP1	4.95	720Y	34.95
5NP1	1.98	721A/B	4.35
6AF6G	.88	723AB	7.95
6C21	24.95	724A/B	4.95
6F4	5.95	725A	9.95
6F4	4.95	726A/B/C	23.50
7BP1	4.95	728A	24.95
7BP7	4.95	750TL	49.50
7C23	75.00	800	2.25
7C24	80.00	801A	.98
7C25	90.00	802	4.25
7DP4	17.95	803A	12.95
9C23	250.00	804	12.95
9GP7	15.00	805	5.95
9JP1	7.95	807	1.25
9NP1	15.00	808	1.89
10Y	.69	810	2.93
10SPEC.	.69	812	7.95
10BP4	24.50	814	2.95
10CP4	29.50	812H	6.90
12DP7	14.95	813	8.95
12DP8	14.95	814	3.95
12FP7	14.95	815	2.95
12GP7	14.95	816	1.19

Type	Price	Type	Price
826	.69	FG95	9.95
829A/B	7.95	FG105	19.95
830	2.95	FG125A	12.50
830B/3E29	7.95	FG235	59.50
830C	2.95	FG238H	140.00
830D	5.25	GL146	11.00
832A	34.50	GL473	65.00
834	5.95	GL502A	1.98
836	1.15	GL530	49.50
837	2.50	GL559	5.35
838	3.95	GL673	11.50
841	.69	GL697	150.00
843	.69	HF100	3.95
845/W	4.95	HF200	17.95
849A/H	69.50	HF210	17.95
850	22.50	HF300	17.50
851	75.00	HK254	19.95
854	3.00	HV18	12.95
855	49.95	HY615	1.25
856	.69	HYE146	.69
858	2.98	KU101	150.00
860A	.99	KU101	9.95
866JR	1.19	MX408U	.49
868	2.95	P273	1.35
874	2.49	P273	1.35
876	2.50	R100	3.75
878	2.49	R200	7.95
884	1.49	R1130	12.95
885	.98	RK20A	7.50
889	140.00	REL36	.98
891	110.00	RK32	3.95
892	115.00	RK33	4.95
902P1	7.95	RK31	2.50
903	11.95	RK33	.98
907	11.95	RK34	.59
915	1.75	RK39	1.75
917	1.50	RK51	3.95
918	1.50	SR45Y	4.50
922	1.00	SR45Y	5.95
925	.98	SR45Y	.79
928	1.40	SR45Y	1.98
930	1.00	SR45Y	12.95
931A	4.95	SR45Y	24.95
934GT	1.50	SR45Y	1.95
949A	69.50	SR45Y	3.95
950	.98	SR45Y	3.95
954	.75	SR45Y	10.00
955	.75	SR45Y	1.50
956	.75	SR45Y	1.75
957	.75	SR45Y	3.95
958A	.75	SR45Y	10.95
959	2.95	SR45Y	1.50
964A	2.95	SR45Y	2.95
972A	2.95	SR45Y	8.95
975A	14.95	SR45Y	.75
991	.75	SR45Y	6.95
1613	.75	SR45Y	.98
1614	1.75	SR45Y	.98
1616	1.39	SR45Y	.75
1619	.75	SR45Y	1.49
1620	4.95	SR45Y	.98
1621	.98	SR45Y	.75
1622	1.75	SR45Y	3.00
1623	1.75	SR45Y	1.19
1626	.49	SR45Y	14.95
1628	4.95	SR45Y	14.95
1629	.69	SR45Y	150.00
1631	1.50	SR45Y	105.00
1633	.89	SR45Y	1.95
1634	.79	SR45Y	.88
1636	5.95	SR45Y	150.00
1638	.98	SR45Y	14.95
1641	.79	SR45Y	1.69
1642	.98	SR45Y	.98
1643	1.49	SR45Y	1.06
1645	1.98	SR45Y	2.05
1649	1.25	SR45Y	.75
1665	1.19	SR45Y	.75
1851	1.25	SR45Y	.98
1852	1.06	SR45Y	.98
1853	1.06	SR45Y	.98
1940	.95	SR45Y	.98
2050	1.19	SR45Y	.98
2051	.98	SR45Y	.98
2051A	4.95	SR45Y	.98
2551A	4.95	SR45Y	.98
2551B	8.95	SR45Y	.98
2552	10.00	SR45Y	.98
2552A	.39	SR45Y	.98
2552B	4.95	SR45Y	.98
2552C	4.95	SR45Y	.98
2552D	4.95	SR45Y	.98
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2552F	4.95	SR45Y	.98
2552G	4.95	SR45Y	.98
2552H	4.95	SR45Y	.98
2552I	4.95	SR45Y	.98
2552J	4.95	SR45Y	.98
2552K	4.95	SR45Y	.98
2552L	4.95	SR45Y	.98
2552M	4.95	SR45Y	.98
2552N	4.95	SR45Y	.98
2552O	4.95	SR45Y	.98
2552P	4.95	SR45Y	.98
2552Q	4.95	SR45Y	.98
2552R	4.95	SR45Y	.98
2552S	4.95	SR45Y	.98
2552T	4.95	SR45Y	.98
2552U	4.95	SR45Y	.98
2552V	4.95	SR45Y	.98
2552W	4.95	SR45Y	.98
2552X	4.95	SR45Y	.98
2552Y	4.95	SR45Y	.98
2552Z	4.95	SR45Y	.98
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2554	4.95	SR45Y	.98
2555	4.95	SR45Y	.98
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2567	4.95	SR45Y	.98
2568	4.95	SR45Y	.98
2569	4.95	SR45Y	.98
2570	4.95	SR45Y	.98
2571	4.95	SR45Y	.98
2572	4.95	SR45Y	.98
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2578	4.95	SR45Y	.98
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2580	4.95	SR45Y	.98
2581	4.95	SR45Y	.98
2582	4.95	SR45Y	.98
2583	4.95	SR45Y	.98
2584	4.95	SR45Y	.98
2585	4.95	SR45Y	.98
2586	4.95	SR45Y	.98
2587	4.95	SR45Y	.98
2588	4.95	SR45Y	.98
2589	4.95	SR45Y	.98
2590	4.95	SR45Y	.98
2591	4.95	SR45Y	.98
2592	4.95	SR45Y	.98
2593	4.95	SR45Y	.98
2594	4.95	SR45Y	.98
2595	4.95	SR45Y	.98
2596	4.95	SR45Y	.98
2597	4.95	SR45Y	.98
2598	4.95	SR45Y	.98
2599	4.95	SR45Y	.98
2600	4.95	SR45Y	.98

Type	Price	Type	Price
ILC6	11.06	6L6G	11.16
ILD5	1.06	6L6GA	1.16
ILE3	1.06	6L7	1.16
ILH4	1.06	6L7A	1.16
ILN8	1.06	6N6G	1.16
IN8GT	.88	6N7	.96
IP5GT	1.06	6N7GT	.96
IR4	1.06	6P5GT	.96
IR5	.80	6P6G	1.06
IS4	.96	6P7GT	.96
IS5	.72	6R7	.96
IT4	.80	6R7GT	.96
IT5GT	1.06	6S7	1.28
IV	.88	6S7GT	1.28
2A3	1.28	6SA7	.66
2A4G	1.28	6SA7GT	.66
2A5	.88	6SB7Y	.66
2A6	1.06	6SD7GT	.72
2A7	1.06	6SF5	.66
2B7	.98	6SF5GT	.72
2V3G	1.98	6SF7	.66
2X2A	1.25	6SG7	.66
3A4	.39	6SH7	.66
3A5	1.49	6SJ7	.66
3A8GT	1.98	6SJ7GT	.66
3B7	.36	6SK7	.66
3K32	.36	6SK7GT	.66



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**Dynamic\* Test Method**—First used by Jackson test tubes under actual load conditions.  
**Tests Over 700 Types**—Including TV rectifiers and sweep tubes.

\*TM Reg. U. S. Patent Office

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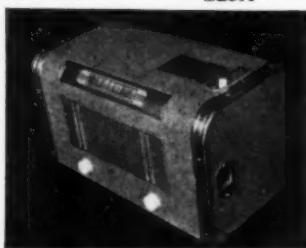
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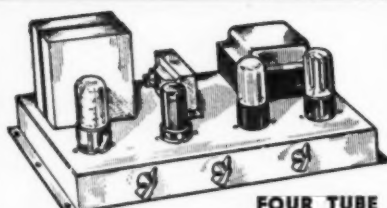
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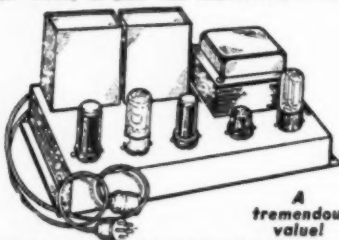
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## Horn-Type Transducer

(Continued from page 56)

space forms a coupling chamber of constantly diminishing cross section.

Fig. 1 shows the method of introducing the tweeter horn into the basic unit and facing the low-frequency driver into the sound chamber. The enclosed back space is ample to allow for back wave release ports which reinforce the low and middle range, thus eliminating dead spots near floor level. Note how the back wave emerges from the space between the sloping sides of the transducer and the wall. This back wave reflex principle is encountered in the Jensen "bass reflex" baffles now available.

A photograph of the completed unit is shown in Fig. 1. It does not show a recently-designed plastic extension of the exponential flare.

This extension increases the efficiency of the integral space transducer without adding to its apparent height. It is also possible to lengthen this plastic extension under conditions where greater control may prove desirable.

It is now evident that the tri-rigid construction of this horn has resulted in a unit of light weight, yet immense strength. The over-all appearance is neat, compact, and of pleasing modern form. This is a long cry from the past, when instruments resembling gigantic cow horns protruded into the apartments of sound enthusiasts who wanted the best, but who found it necessary to sacrifice appearance and comfort for their personal idiosyncrasies.

Upon hearing one of these horns, a person becomes keenly aware of the amazing possibilities in sound reproduction. Even the elusive transient sounds are present in true perspective, with little of the distortion so common to direct radiator loudspeakers mounted in conventional baffles.

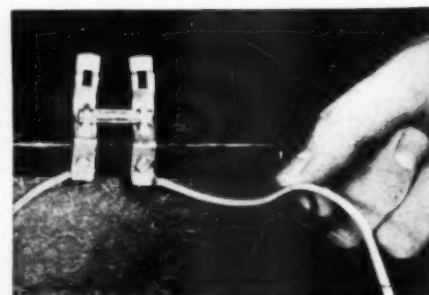
—30—

## GLASS FUSE HOLDER

IT IS often desirable to insert a small glass type fuse in a circuit used for experimental purposes.

Battery clips from discarded "B" batteries may be bent and arranged so that the inside sections of the clips will hold the fuse as illustrated.

The opposite ends of the clips may be drilled and fastened to a wood base with screws. . . . H.L.



RADIO & TELEVISION NEWS



## Wide-Range Amplifier

(Continued from page 48)

across the high voltage, or the plate voltage of the output tube may be dropped slightly. At any rate, if the circuit components are followed closely, the current should be very nearly 150 milliamperes.

Although they are not shown on the diagram, one megohm resistors are shunted from each grid to ground on the 6AS7G. These resistors may or may not be needed. In this amplifier there was a tendency to oscillate at some supersonic frequency, and adding the resistors eliminated this trouble, their value being primarily that they have no effect on the frequency response. A low-voltage meter should be connected across the plates of the tube and the slider on  $R_{23}$  adjusted for zero reading, balancing the plate current. This will take care of the adjustments for this stage.

The test curves were taken with a standard audio oscillator, using an oscilloscope and an output meter. Maximum output without visible distortion was just less than 10 watts. With the tone controls disconnected, output was flat to a fraction of a decibel from the limits of 20 to 20,000 cycles of the audio oscillator. The tone control curves were taken with a .04  $\mu$ fd. condenser at  $C_{23}$  as recommended by the control manufacturers. This later was changed to .03  $\mu$ fd. to increase the frequency point where treble boost begins as well as the treble cut. This reduced somewhat the noticeable increase in loudness with treble boost.

Output response through the phono input was also taken. The variations are for constant output with varying input. Incidentally, all the curves were made with the output running around 5 watts. The curve as shown through the phono input follows quite closely the desired response. To this must be added a slight droop of the pickup cartridge caused by the 10,000 ohm resistor across the input. Disconnecting  $C_{13}$  resulted in the second curve. The relatively high grid impedance, plus the high mu triode, causes an attenuation to occur through capacity effects. The second curve may be preferable to some; however, the 6 db. per-octave deemphasis is satisfactory for most records. The tone controls provide sufficient variations so that most records can be made to sound right.

The operation of the dynamic noise suppressor is rather interesting. The circuit is a slight modification of the original circuit described by C. G. McProud. With the control turned to maximum suppression position, screen and plate voltages are 32 and 18 volts respectively, measured by a vacuum tube voltmeter having an input resistance of 15 megohms. With the control turned to the other extreme, the contact potential developed by the 6SL7GT offers bias, decreasing the



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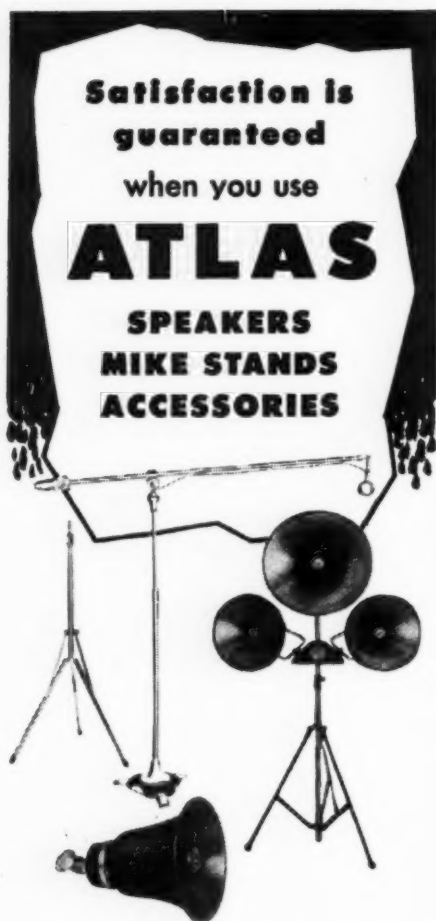
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plate current; the voltage rises to 50 which consequently raises the cut-off frequency. A section of a single pole, double throw switch is utilized so that further turning the control switches in negative bias taken from the heater string. This, in effect, switches the reactance tube out of the circuit, which was found desirable at times. This final circuit was found satisfactory with a *Pickering* cartridge; suppressor action was sufficient on various records. Tests on a *Universal* frequency record showed a droop beginning at around 3000 cycles and down about 6 db. at 4000 with suppression full on. Turning the control, allowing the rectified voltage to act on the reactance tube grid, raises the cut-off frequency somewhat and at the same time allows dynamic action to take place.

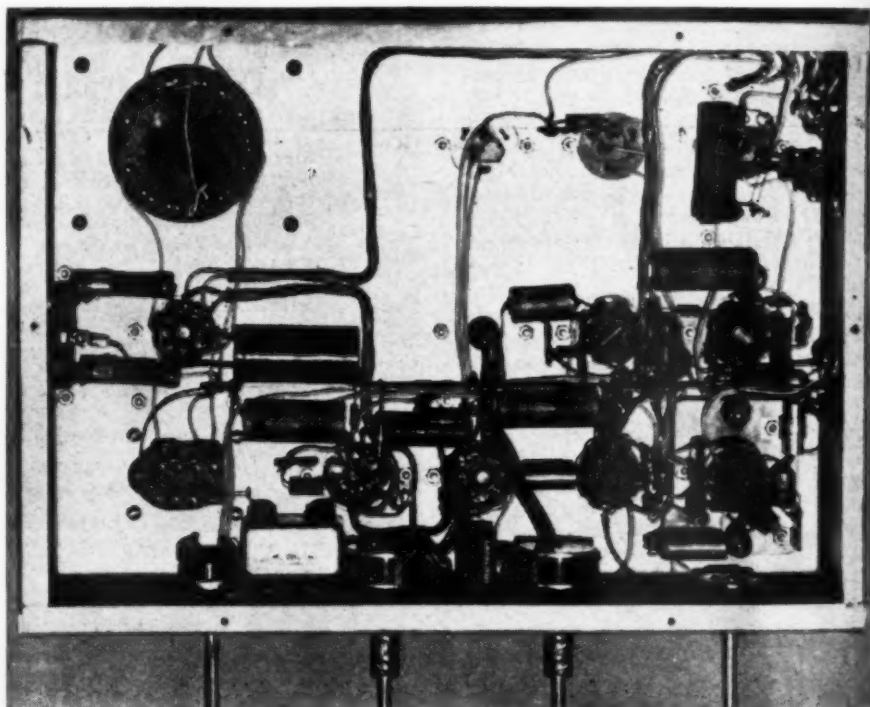
With a constant level signal of varying frequency, the rectified voltage measured at the plate of the 6SL7GT (at the high end of the suppression control) reached a maximum at 4000 cycles, with the reactance tube disconnected. This is the desired response for the side amplifier. The highest possible fundamental tone of any musical instrument runs close to this value, allowing the harmonics of this fundamental to pass through. High-frequency signals above this frequency as well as frequencies below this 4000 cycle point do not have nearly the same effect on the reactance tube. This provides for the reactance tube's staying "closed" on hiss and other high-frequency noise, as well as during the periods when there are no high-frequency notes to mask the hiss. The action of the suppressor can be observed by connecting a vacuum tube voltmeter to the plate of the 12SG7. The plate voltage will swing up to the plate supply voltage on

high-frequency passages, depending on the actual setting of the suppressor control.

Due to the lower output of the *G-E* cartridge with circuit values as shown, the side amplifier did not give enough amplification for sufficient range of dynamic action. On low level records with the control turned up for maximum action, it was felt the action was insufficient. Adding  $C_n$ , shown as dotted lines on the diagram, increased the gain somewhat without altering its response characteristics. Further, the 12SG7 is replaced by a 12SH7, the latter having a higher grid sensitivity than the former. The relatively high value of  $R_s$  in the screen lead allows for some variable mu characteristic introduced to the 12SH7 so that abrupt cut-off does not occur. The values as shown for the resistors are satisfactory for the 12SH7. Measured voltages were 36 for the screen and 18 for the plate. With the control turned for maximum sensitivity, the contact potential raised the plate voltage to 100, due to the higher grid sensitivity of this tube. On subjective testing of scratchy records on both 12SH7 and 12SG7, the greatest apparent reduction of scratch seemed to occur with plate voltage varying from 150 to full-supply voltage. Variations that occurred below this value did not have as much effect.

The screen voltage on both tube types has considerable effect on the plate voltage. Reducing screen voltage increases the measured plate voltage as well as the grid sensitivity of the tube. Raising the screen voltage lowers the plate voltage, and there is also a point where further increasing the screen voltage and dropping the plate results in an increased cut-off frequency which brings about the re-

Under-chassis view of the home-built, wide-range phono amplifier.





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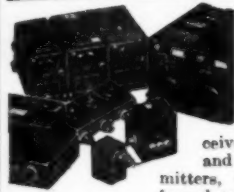
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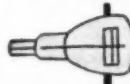
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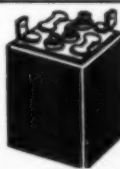
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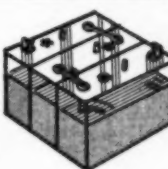
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verse effect. The values of plate and screen voltage are satisfactory. It was found best not to drop the plate voltage much below 20. The value of  $C_1$  was satisfactory for both *G-E* and *Pickering* cartridges on listening test, though there is some difference between the inductance of the two.

Relative simplicity and the few parts required make the suppressor well worth incorporating. For some that do not desire dynamic effect, the side amplifier may be omitted and a d.c. bias applied to the control, which will result in a variable cut-off control that can be located remotely from the input terminals.

Subjective tests on the amplifier as a whole were very satisfactory. The 6AS7G tube, with its low plate resistance, contributes greatly to this test. While excellent results may be obtained with beam power tubes with

large inverse feedback, the simplicity of using low impedance triodes for home construction use is an advantage.

It should be mentioned here that a wide-range amplifier requires associated components of equal quality to realize the full benefits on high fidelity. Turntable rumble that was scarcely noticeable on a previous amplifier became quite apparent, and this can become quite serious with bass boosting. The magnitude at a few cycles may be sufficient to overload the amplifier while having little audible effect other than the intermodulation of the desired frequencies. With a high-quality magnetic pickup this amplifier is capable of reproducing with full justice the full range of recorded frequencies. Full appreciation may be realized on high quality FM broadcasting.

## IMPROVEMENTS ON EARLY TELEVISION SETS

By WILBUR J. HANTZ

SOME television receivers currently manufactured have incorporated in them a means by which the operator may select a linear rectangle or larger round, close-up picture. Of course, the outer edges of the pictures are missing, but this does not detract from the over-all effect, or cause attention to be directed from the center. This same improvement can be effected in some of the earlier receivers without much difficulty or cost.

To enlarge the picture height and width without introducing a great deal of distortion, the vertical and horizontal oscillator sweep amplitudes must be changed accordingly. This can best be understood by considering a circuit of a typical multivibrator horizontal sweep oscillator of a small receiver, using a 7JP4 kinescope.

A 12SN7GT is used as the oscillator and discharge, followed by another 12SN7 as the horizontal amplifier. The 2.5 meg. width control functions as a voltage divider supplying one plate of the 12SN7 discharge section, and it controls the amplitude of the sawtooth output.

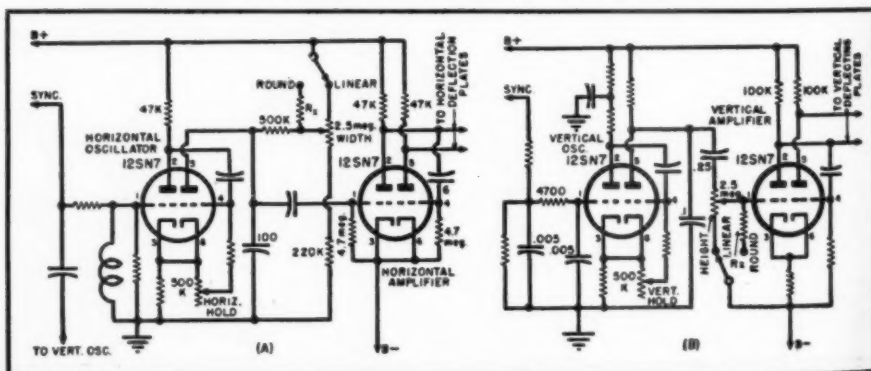
In the vertical sweep oscillator circuit, a second pair of 12SN7's is used similarly, only the 2.5 meg. height control is connected as a gain control in the grid of the vertical amplifier.

There are several methods that can be employed to obtain this effect, but

only the simplest will be given here. Use a double pole, double throw switch and two resistors. Since the amplitude of the horizontal oscillator output depends upon the value of the width control, we can arrange to switch a resistor in here of the proper value, which is found by turning on the receiver, letting it warm up thoroughly, then turning the width and height controls until the picture completely covers the kinescope tube. Now turn the set off, and with an ohmmeter measure the amount of resistance left in the "B+" end of the width control. This is the value that will be switched in here in place of one-half of the control.

In the vertical oscillator section, measure the amount of resistance left in the low or ground end of the height control and the grid of the 12SN7 vertical amplifier. This is also the resistance value to be used here. The exact amount of resistance used varies in different makes of sets. If enough vertical sweep amplitude cannot be obtained with the control turned all the way, it may be necessary to switch this resistor in series with the ground end of the control. These changes will not affect the regular functions of the controls, because when the regular linear picture is used, the added resistors are switched out of the circuit.

Conventional horizontal (A) and vertical (B) sweep oscillator circuit.





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### 4 PRONG VIBRATORS—VERY BEST BRANDS

Standard replacement—Sensational Value

**\$129 ea.**

### OCTAL SOCKETS

10 for 49c

### CRYSTAL CARTRIDGE

Standard replacement crystal cartridge. Each

**\$1.39**

### FILTER CONDENSERS

Very best brands. Fresh stock



450 Working Volts

Size	Price
8-450 V	ea. 21c
10-450 V	ea. 24c
10-450 V with 20-25 V	ea. 29c
15-450 V	ea. 29c
20-450 V	ea. 39c
30-450 V	ea. 49c

150 Working Volts

Size	Price
15-15-150 V	ea. 29c
20-20-150 V	ea. 29c
20-20-20-150 V	ea. 39c
30-30-150 V	ea. 39c

Rated accounts—10 days—all others 20% deposit with order, balance COD. Minimum order \$5.00. All shipments FOB Chicago. Prompt attention paid to foreign orders. ORDER TODAY Our parts and tubes are warranted to be 100% replacements for the prototypes in the listings above. Satisfaction Guaranteed.

### 10BP4 TV Picture Tube... \$17.95 ea.

### VOLUME CONTROLS

VERY BEST BRANDS

Size	Price
1/2 meg. with switch—long shaft	29c
2 meg. for battery sets—DPST switch, long shaft	29c
1/2 meg., 1 meg., or 2 meg., long shaft, less switch	15c

### BY-PASS CONDENSERS

100 Condensers assorted in package. \$5.95

Size	Price
.001 mfd. 600 V	ea. 6c
.002 mfd. 600 V	ea. 6c
.005 mfd. 600 V	ea. 6c
.01	ea. 7c
.02	ea. 7c
.05	ea. 8c
.1	ea. 9c

### 400 VOLT BY-PASS CONDENSERS

Size	Price
.2 mfd.	ea. 6c
.25 mfd.	ea. 10c
.5 mfd.	ea. 15c

### BUFFER CONDENSERS

Size	Price
.005 mfd. 1600 WV	ea. 15c
.008 mfd. 1600 WV	ea. 15c
.01 mfd. 1600 WV	ea. 15c

### VARIABLE CONDENSERS

Two gang for superhet Standard 3/4" shaft

**69c**

### OUTPUT TRANSFORMERS

For 50L6, etc.

**39¢ ea.**

For 6V6, 6F6, 3Q5, etc.

**45¢ ea.**

### UNIVERSAL OUTPUT TRANSFORMER SPECIAL:

Up to 8 watts to any speaker (while they last)

**98c ea.**

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1 box of 10 bulbs

**\$4.90**

Size	Price
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No. 41 2.5 V .50 Amps.	54c
No. 44 6-8 V .25 Amps.	54c
No. 46 6-8 V .25 Amps.	54c
No. 47 6-8 V .15 Amps.	54c
No. 51 6-8 V .20 Amps.	54c

### 6-Ft. LINE CORDS

Good Rubber with plug. 10 for

**\$1.25**

Underwriters' Approved. 10 for

**\$1.69**

### SELENIUM RECTIFIERS

Standard 100 mil. Each

**79c**

### PUSH-BACK WIRE

100 ft. rolls

**39c each**

**PREMIER RADIO TUBE COMPANY, 1812 Winnemac Ave., Chicago 40, Ill.**

"Your Tube Source Since 1926"



# Sharp, Clear Television Reception at 100 MILES AND OVER

## USERS REPORT...

**FLORIDA**—clear reception in Lake Wales from Miami—174 miles

**MISSOURI**—clear reception in Joplin from Kansas City—146 miles

**NEW YORK**—clear reception in Belmont from Syracuse—111 miles

**CALIFORNIA**—clear reception in Bakersfield from Los Angeles—128 miles

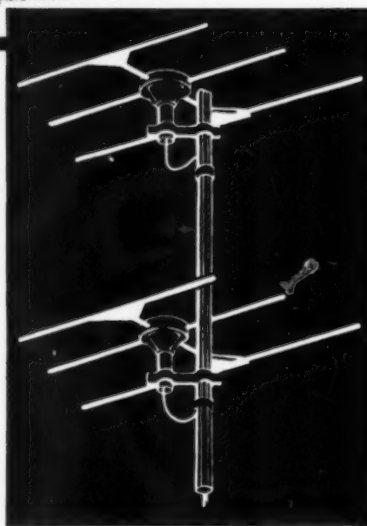
These remarkable performance records were achieved by Workshop six-element, super-high-gain antennas. If you want to be absolutely sure of outstanding reception, specify Workshop Model 2A.

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Channels 2 to 6.....\$52.00

Channels 7 to 13..... 43.50

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**THE WORKSHOP ASSOCIATES INCORPORATED**

62 Needham Street, Newton Highlands 61, Mass.

## NEW!

### MOSLEY TAP-SOCKET

TAP SOCKETS can be installed along a 300 ohm transmission line where it is desired to connect a TV or FM receiver. With several TAP SOCKETS on a line, any one of several receivers can be selected and quickly plugged to a single antenna lead-in. TAP SOCKETS permit a receiver to be moved to different positions in a room. Line is not cut or damaged and no solder needed. Designed for MOSLEY CAT. 300P PLUG.



CAT. 300-TS—List Price.....58c Ea.

### MOSLEY CAT. 300-1P

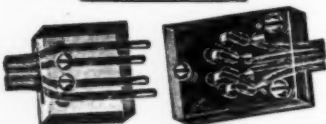


A special PLUG designed for use with Federal Intelin K-111 Cable. Has clamp to hold cable securely to remove strain from small conductors. A

solder lug is provided with which to ground shield. PLUG has 1/2" Pin Spacing for use with MOSLEY CAT. 300SB BASE SOCKET.

List Price.....\$1.25 Ea.

### MOSLEY CAT. 300-2P



A special Polarized PLUG and SOCKET designed for 4 wire transmission line and used on low voltage installations such as the one used on Alliance Tenna-Rotor and others. PLUG and SOCKET sold as a unit.

List Price.....\$2.00 Set

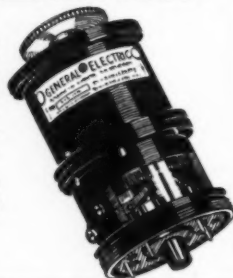
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110 volts, 60 cycle, 2.2 watts, 1/240 R.P.M.

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ea. net, new

#### Type 36938-2

110 volts, 60 cycle, 2.2 watts, 1/2 R.P.M.

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110 volts, 60 cycle, 2 watt, 1/2 R.P.M.

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#### Type 1600

110 volts, 60 cycle, 2.3 watts, 1 R.P.M.

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**INSTRUMENT ASSOCIATES**  
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## Technical BOOKS

**"FUNDAMENTALS OF WRITING FOR RADIO,"** by Rome Cowgill. Published by Rinehart & Company, Inc., New York, N. Y. 300 pages. Price \$3.50.

Proceeding on the theory that the average beginning student tries to understand the techniques of writing for broadcasting before he is quite sure of himself as a writer, the author has included a few chapters of writing hints before entering into the technical aspects of sound effects, transitions, continuity, and dialogue.

Some choice radio drama scripts have been included as examples of good radio continuity. These show how, with the aid of sound effects, music transitions, and other technical tricks, the realistic effects heard every day are produced. The last chapter is devoted to some hints on marketing radio scripts, bracing words of advice and encouragement on free-lance work.

Providing with his own work an excellent example of the soundness of his theories, Mr. Cowgill writes most interestingly and presents his material in understandable form without "talking down" to the reader. After studying this book, with the aid of the exercises given at the end of every chapter, no student could fail to consider that he has received all the help it is possible to communicate by means of such a text.

**"COMMUNICATION CIRCUITS,"** Third Edition. By Lawrence A. Ware and Henry R. Reed. Published by John Wiley & Sons, Inc., New York 16, New York. 403 pages. Price \$5.00.

In line with recent communications developments, the authors of this third edition have applied each problem at hand, whenever possible, to the high-frequency range and present a good deal of information on microwave transmission by means of rectangular and cylindrical wave guides and coaxial cable.

For some portions of the text, a rather advanced knowledge of mathematics is required, and for these problems, special material has been provided in the back of the book for assignment according to need. For the book itself as a whole, however, a knowledge of calculus and the elements of a.c. theory is essential.

A considerable amount of material has been added to this revised text. Chapter 1 having been almost completely rewritten. A change has also been made in certain treatments to conform with procedures growing out of World War II. Portions on impedance matching have been extended, and many new problems have been devised. An Appendix comprising fifty pages presents much helpful practice work including a study of Maxwell's



Equations in relation to wave guides and coaxial cable.

Primarily, the book is designed to lead the electrical engineering student into the elements of hyper-frequency theory as a background for more advanced work. Reference suggestions are given for the benefit of those who wish to progress further. As the text deals with communication circuits from low voice frequencies through the microwave region, it will serve excellently as introductory material for any field of communication contemplated by the student.

**"TV PICTURE PROJECTION AND ENLARGEMENT,"** by Allan Lytel. Published by John F. Rider Publisher, Inc., New York 13, N. Y. 192 pages. Price \$3.30.

In this up-to-date publication the author offers some valuable material that is quite different from that usually prepared on television subjects. The book undertakes to instruct on only one aspect of TV receivers, the optical systems employed, with special emphasis on the projection types. No circuits are included, but the thorough treatment given to the basic principles and theory of operation of lenses and optics should prove very helpful to the serious student.

For example, the first chapters concentrate on the properties of light, reflection, and mirrors and the rules and principles of refraction and lenses as a preliminary to the study of television pictures and projection systems. Following chapters on the television picture discuss the many ways of viewing the picture, providing descriptions of magnifiers used with the direct-view types of receivers. Subsequently, direct-view systems are contrasted with projection TV, and a long chapter describes commercial applications of the modified Schmidt projection system. This is followed by a study of refractive projection.

Questions at the end of each chapter drill the reader on the material covered therein, so that no aspect will be overlooked or misunderstood. An extensive bibliography and well-formulated index conclude this authoritative work.

-50-



"I haven't a 275,000 ohm resistor, Ed, but if you put these in series you'll have it on the head!"

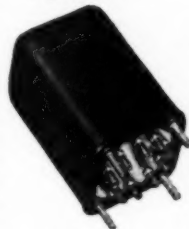
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Freq. Response,  $\pm 0.5$  db, 20 to 20,000 Cycles



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BI-7

**BI-7 INPUT:** low impedance mike, pickup, or multiple line to grid(s). Pri: 50/150/250/600 ohms. Sec: 50,000 ohms CT. Unique in the field—has continuous, tapped primary winding that needs no series-parallel connections. Impedance changes are simple with rotary switch. Oper. level, +15 dbm. Hum reduction, -70 dbm. Sealed in compact, drawn steel case,  $2\frac{1}{4}" \times 2\frac{1}{4}"$ . List price, \$23.00

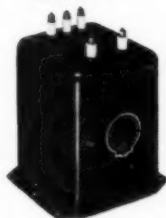
**BO-9 OUTPUT:** P-P plates to line or voice coil. Pri: 5000/3000 ohms CT. Sec: 600/150/16/8/4 ohms. Ideal for use with 6AS7-G, 6B4G's, 2A3's, etc. Stated freq. response measured at operating level of +40 dbm. In drawn steel case,  $4\frac{1}{4}" \times 3\frac{1}{4}" \times 3\frac{1}{4}"$ . List Price, \$22.00

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## LOW PASS FILTER AND SPLATTER CHOKES

For limiting band width in low/high level speech applications



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**LPF-1 FILTER,** for attenuating frequencies above 3000 cycles in low level speech amplifiers for aircraft, police, amateur, and other communications use. Operates from a 15,000-ohm source (plate of 6C5, 6J5, or triode 6SJ7) to a 100,000-ohm grid (step-up ratio, 2.6 to 1) or to a 500-ohm line. Has extremely sharp cut-off characteristics and negligible insertion loss. Operates efficiently at signal levels up to -8 db. A complete, self-contained filter in a compact, drawn steel case only  $2\frac{1}{4}" \times 2\frac{1}{4}" \times 2\frac{1}{4}"$ . List Price, \$10.00

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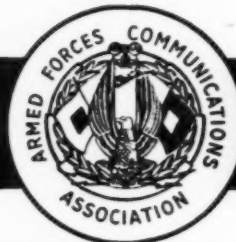
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# AFCA



# NEWS

This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance and operation of communications and electronic equipment for Army, Navy, and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join. Dues are \$5.00 per year. Application should be submitted to the secretary at 1624 Eye St., N. W., Washington 6, D. C., who will furnish details upon request.

### Executive Committee Meeting

AFCA President Fred R. Lack of Western Electric presided at the Executive Committee meeting at national headquarters on September 14th. Col. Rex. B. Corput of the Office of the Chief Signal Officer and Col. T. J. Tully of Fort Monmouth were also present to participate in the discussion of general plans for the 1950 annual meeting of the association in New York City and Fort Monmouth, N. J.

### Honor Roll

The Council voted in June to follow the lead of several professional societies and establish an honor roll for the purpose of perpetuating the names of distinguished pioneers and members now deceased of the association. Not more than one name may be added each year to this list. Elected by the Council were:

Maj. Gen. C. M. Saltzman, former Chief Signal Officer, who, with Brig. Gen. J. J. Carty, also named, founded the American Signal Corps Association after World War I; Brig. Gen. J. J. Carty, distinguished industrialist, with the AT&T Co. and reserve officer; and Maj. Gen. George S. Gibbs, former Chief Signal Officer, later president of Postal Telegraph Co., and charter life member of the association.

### Membership

1st lieutenants and lieutenants jg. and below are now eligible for the \$3.00 associate membership. Student membership at \$2.00 is now available for USMA, USNA, and technical school students for one year after graduation, as well as while in undergraduate status.

### Naval Communications Chief

Rear Admiral John R. Redman, new

Chief of Naval Communications, has been made an honorary life member of the association. This is in accordance with the policy established by the board of directors last spring of extending honorary life memberships to each of the three Chiefs of Communications upon appointment.

### AFCA CHAPTER NOTES

#### Baltimore

The first fall meeting was held on September 14th at Fort George G. Meade, Md. After the business meeting and dinner at the Battalion Mess, 51st Signal Operation Battalion, visits were made to the Communication Center, Military Amateur Radio Station and Photographic Laboratory and Library. A display of tactical equipment of the 51st Signal Operation Battalion, including the modern AN/MSC-1, Mobile Signal Communication Center, rounded out the evening's activities.

#### Pittsburgh

The annual election of officers took place at the September 13th meeting held in the Bell Telephone auditorium. The program included a round-table discussion of the types of meetings desired during the year and the objectives to be accomplished.

The new officers of the chapter are: President—Edward J. Staubit, Blaw-Knox Co.; 1st vice-president—Donald L. Chaffee, Copperweld Steel Co.; 2nd vice-president—Eugene C. Stern, Bell Telephone Co.; treasurer—Charles A. McKenney, Jr., Peoples First National Bank & Trust Co.; asst. treasurer—Hobart H. Drake, Jr., Rust Engineering Corp.; secretary—Sylvester C. Stoeher, Jr. Bell Telephone Co.

#### Southern Chapters

Mr. W. H. Mansfield of the Southern Bell T & T Co., AFCA's area representative for the southeastern area, arranged a series of demonstration-lectures on "Micro-Radio Waves in Civil and Military Communication" by Dr. J. O. Perrine, assistant vice-president of the American Telephone & Telegraph Co. Dr. Perrine appeared before the following chapters: South Carolina on August 31st; Augusta-Camp Gordon on September 1st; Atlanta on September 6th; and Louisiana on September 8th.

Following a simple theme of "waves," Dr. Perrine, a Bell System research physicist for more than a quarter of a century, in a series of dramatic demonstrations built up a visual conception of radio waves and their application in communication, television and radar. Ultra-high frequency radio waves illuminated lights

**RADIO & TELEVISION NEWS**



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Dual Ckt. 105°F/32°F Extremely Sensitive & Accurate for Most Exacting Requirements—RESEARCH LAB. FIRE PREV. FREEZE PT. CONTROL, or MAX-MIN TEMP CONTROL 4 1/2" L. BRAND NEW w/ data & Ckt. List Over \$20. "TAB" SPECIAL..... **98c**

Complete Pwr Supply with  
censors, lamp, data, etc.  
115VAC ..... \$29.95  
Studio Kit Air Corps 115V  
set 115VAC or Batt w/  
lamps ..... \$53.00  
Flash Pwr Pack NEW  
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1169AirC Flash Pwr Pack NEW  
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FlashCndrs-7mfd/2500vdc/21.9W  
-Sec \$2.75; 5 12.50; 15mf/330vac  
1800VDC INT \$3.98; 25mf/330vac  
/1800vdc/INT 6.49; 16mf/1600vac  
/2800vdcINT ..... 6.95

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-Sec Flash Cndra & Data for	
Flash Lamp	\$17.98
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H	17.75	876	...	.35	7C67	...	12.95
L	39.95	878	...	1.05	9GP7	...	12.33
1	1.90	884	6Q5G	1.35	9LP7	...	2.21
HF200	11.98	885	...	.95	10BP4	...	19.75
58	7.45	920	...	2.70	10P4	...	24.50

OA3	VR75	\$	98	287			\$1.05	4347		\$45.00	8R6GT	
OB2			1.05	244			.98	4T4/2		0.95	8K7G	
OB3	VR90		.67	2822	GL559		.73	5C30 C5B		29.00	0K8	
OC3	VR105		.75	2821	1642		.81	5D21		25.95	6L6	
OD3	VR150		.87	2822	7193		.81	5D21		14.25	6L7	
OZ4			.87	2C26			.25	5J29		17.50	6P5G	
CTA			0.95	2C34	RRK34		.25	5J30		49.27	6P5G	
O1A			1.04				18.00	5K1		1.32	6G7	
IA3			.59	2C40			2.88	5T4		1.02	6G7	
IA4			1.28	2C43	464A		8.51	5U4G		.52	8S7G	
IA5GT			.70	2C40			1.89	5U4G		.58	8S7G	
IA6			1.26	2C51			7.98	5W4		.74	6S7GT	
IA7GT			.69	2D21			1.95	5X4G		.71	6S7GT	
IB3	VR016		.95	2C22			1.34	5YGT		.38	6S7GT	
IB21	471A		2.95	2F22			1.34	5Z3		.81	6SD7GT	
IB22			2.90	2F22			1.34	5Z4		.88	8SF3	
IB23			2.95	2F22	HY65		1.34	5Z4		.88	8SF3	
IB24			4.85	2J21			11.98	6A3		.98	8SGT	
IB27			4.75	2J21	6A4		11.98	6A4		1.29	8SH7	
IB29			3.39	2J23			98.00	6A7		.75	6SK7GT	
IB37			45.00	2J23			8.85	6A8T/1853		.84	6SL7GT	
IB38			37.00	2J31			9.85	6AC7		.75	6SN7WGT	
IB40			29.95	2J31			9.85	6AD6		.81	6SQ7GT	
IB41			49.95	2J33			14.97	6AF6G		.87	6S8T	
IB53			49.95	2J34			23.98	6AG5		.72	6T7G	
IB54			49.95	2J37			17.25	6ACG7		1.60	6U5	6G5
IB56			49.95	2J38			13.89	6AJ5		.88	6U6GT	
IB60			29.95	2J39			34.00	6AK6		.81	6V6M	
IC6			1.26	2J48			45.00	6AL5		.75	6V6GT	
IC7G			1.27	2J49			24.00	6AL7		1.50	6W7G	
IE5G			1.38	2J53			40.00	6AR5		.52	6X4	
IE7G			1.17	2J56			81.00	6AS5		.52	6X4	
IE8G			1.45	2J61			39.00	6AT8		1.98	6BGT	
IE7GV			1.55	2J62			30.00	6A8T		4.40	6V6	
IG4GT			1.05	2K23			24.80	6AT8		.53	6Z6	
IG6GT			.87	2K28			24.80	6AU8		.43	744	XXL
IH4G			.87	2K29			24.95	6AV6		.74	745	
IH5G			.85	2K39			54.00	6B7		1.05	747	
IO6G			1.27	2C2G			1.88	6BF6		.80	748	
IJ6			.98	2X2			.27	6BF6		.80	748	
IL4			.49	3A4			1.38	6BF6		.80	748	
IL4AGT			.49	3A4			1.38	6BF6		.80	748	
ILB4			1.05	387	1201		.95	6B8G		.75	748	
ILC6			.85	3B22			2.68	6BF6		.80	748	
ILF3GT			.86	3B24			2.68	6BF6		.80	748	
ILH4			1.05	3B25			4.95	6BH6				

4/2	9.45.00	6K6GT	9
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20	29.95	6K8	
30 C5B	9.95	6L5G	
21	25.95	6L6	
23	14.25	6L7GT	
24	17.39	6M7G	
24	1.12	6P5G	
40	96	6Q7G	1
40	52	6S7G	
40	74	6S8GT	
40	71	6S8GT	
38	31	6S8GT	
38	68	6S8GT	
40	8.33	6S8GT	
3	9.95	6S8GT	
3	1.29	6S8GT	
3	1.02	6S8GT	
B7/1853	7.75	6S8GT	
D7	1.08	6S8GT	
C8	.81	6S8GT	
D7	1.17	6S8GT	
FGG	.87	6S8GT	
AG5	.72	6T7G	1
H6	.98	6U5 6G5	
H5	.73	6U6GT	
J5	.75	6V6	
K6	.81	6V6M	
KL5	.81	6V6GT	
KL6	.81	6V6GT	
1	1.00	6V6GT	
1	.52	6W7G	
1	.52	6X4	
1	1.58	6X5GT	
ASTG	4.40	6Y6	
1	.53	6Z7G	
1	.43	744 XXL	
1	.98	7A5	
1	1.05	7A6	
1	.59	7A7	
1	.59	7A8	
1	.59	7B4	
1	.59	7B5	
1	.59	7B6	
1	.59	7B8	
1	.59	7F4 120SA	
1	.59	7C6	
1	.59	7C7	
1	.59	7C8	
1	.59	7E5 1201	
1	.59	7E6	
1	.59	7F7	
1	.59	7F8	
1	.59	7K7	
1	.59	7L7	
1	.59	7Q7	
1	.59	7S7	
1	.59	7T7 7GT	
1	.59	7V7	
1	.59	7W7	
1	.59	7X7	

[illegible]

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1/5a, 12v/14.25a, 19.2v-18.3v, 17.5v @ 5a

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ct or 21000voltDbir/95ma . . . . .	\$10.95
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HI-VOLTAGE 6000-10000 V  
Tubes 32 to 100

Tubes: 6X4 to 6X5  
 Plate: 300V to 500V  
 Tubes & All  
 Complete & All  
 5000 to 20000  
 Circuits: also  
 Outpt 300VDC/2  
 6.4V/10.3A, 5.0  
 2.5V/3A, Inpt 1  
 VAC/50-400cyc  
 Oil Impreg. W.E. for  
 CRT Xmr 1800V Disl. C  
 npt: Outpt- 900V/35ma  
 ea. Sect.4KV ins. Sig C  
 Sid. 2x2 tubes & C  
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lation Stancor USN H'sld  
to P807's RF 2000chm L

7's to 829HCA5500 to  
tran USN 3600 or 9000  
500W  
I 12W UnivOutp4 5000  
ANY VC  
Output 300WattPF805  
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LVM-11 line autoform  
0.14 "ouncer" 30:1 Mike

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ly Hi-Efficiency  
Fact 5 1/2 x 3 3/4  
Lo-temp rise.  
**K N T G MAG**  
Inpt: 5.5VDC  
1/50Ma  
4 3/4 lbs. net. ONLY  
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13.5Hz/ Amp  
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Swinging  
Cased  
12HY 300m  
3HY 40ma.  
3 for  
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**Best Buy—5 Ma DC Tuning Meter.**

G-E, 2 1/2" dia. BkltCsd SPECIAL. 1

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Voits, DCVoits & Ohms; Red &  
Black K.E.ptir; for RCA Voit-  
ohms J.R. .... \$7.  
100-0-1000-0 AC, 1000-0 AC, 1000-0  
Mvt Cross-Landing Indicator. 2

**DC MILLIAMMETERS**

0-10maKt 0-5KV, Basic 1maMvt,  
3 1/2" SIMPSON ..... \$4  
0-10maKt 1KW, Basic 1maMvt, 3  
0-1.25ma, 1 1/2", 500 Mtn, Dipper Mtr., 3  
0-50ma, 2 1/2" Ameco DeJux. 3

**DC MICROMHOS** 0-3000umhos,  
4"x3 $\frac{3}{4}$ ". Hickock Mutual Cond

Tube Checker, Scale: Replace—?	
—Good .....	9
<b>DC AMMETERS</b>	
0-1A, 3 1/4" Wtchs	\$3
0-2A, 3 1/4" GE & Wtchs.	3
0-15A, 2 1/4" Hoyt	2
0-30A, 2 1/4" Shunt WECO & Wstg.	2
0-35A, Int. Shunt WECO	2
0-60A, 2 1/4" Int. Shunt, WECO	3
0-120A, 2 1/4" w/ExtShunt WECO	3
& Wstg	3

30-0-30A, 23 $\frac{1}{8}$ " Weston 203P

[illegible]

115VAC 60cye. Output 2.5  
VCT/10A 10KV Insul 4

Sockets & Tubes  
KIT G823A's  
12.5Kv \$5.95  
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**BLOWERS—Cool that Tube**

40 CFM 28vacde	\$3.45
100 CFM 12vacde	8.95
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Xfmr or 28V to 115vac	1.99
250 CFM 28vacde	9.95
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**CONDENSER SPECIALS!!**

2x5mfd (10mfd) OILMITE to W.E. Special  
K\$8976 rated 400WVDC — 65 to +65° C  
GTD Usable 600WVDC "TAB" SPECIAL  
2 for 98c.  
Dual .1mfd/2000WV Common term oil  
Ground TOBE Mfr..... 11.00; 2 for \$  
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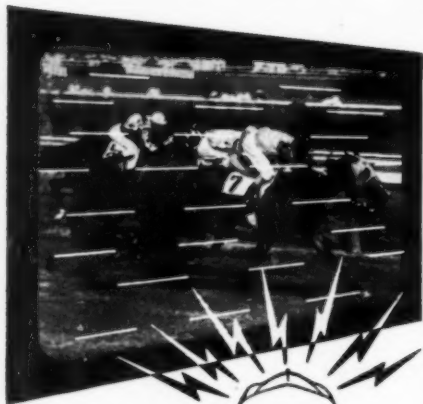
**OIL CONDERS—NEW—Famous Make**

.0016	15000	4.98	1	4000	3.7
.002	7000	88	1	7500	3.7

0.02	1500	.98	1	7500	
0.075	1500	1.25	1	2500	93.6
.05	1500	.99	2	1000/330AC	
.03	7500	1.98	2	1500	4.4
.05	1500	.39	2	2000	1.1
.05	4000	1.89	2	3000	3.3
.1	1000	.39	2	5000	9.9
.1	1500	.59	2	5500	10.9
2x.1	1500	.78	3	12500	19.9
.1	2000	.89	3	6000	3.4
.1	5000	1.98	3	4	260
.1	7500	1.98	4	1000/330AC	
.2	5000	2.25	4	1500	2.3
.25	1000	.59	4	2000	5.5
.25	2500	.74	4	3000	5.5
.5	1500	.98	4	5000	16.6
.5	3000	2.49	5	600	
.65	12500	14.89	5	1000	1.1
1	1000	.45	5	1500	2.4
1	1500	1.09	5	2000	4.5



# ...Help end spark plug INTERFERENCE



Spark Plugs are miniature broadcasting stations, send signals that interfere with radio reception, distort television. The New Auto-Lite "Resistor" Spark Plug reduces this interference.\*



## Recommend NEW AUTO-LITE Resistor SPARK PLUG

### Here's How It Works to End Interference

The "Resistor" acts to dampen the spark plug radio signal to an acceptable level\* while still delivering the full high voltage discharge required to ignite the fuel.



Auto-Lite Ignition Engineers, working with leading automotive manufacturers, have developed the new Auto-Lite "Resistor" Spark Plug with this built-in resistor that reduces spark plug interference.\* Remember, the "Resistor" also helps deliver smoother idling, improved economy, longer electrode life. Dealers are being supplied as rapidly as possible. Write for Booklet M-1186 for full information.

THE ELECTRIC AUTO-LITE COMPANY  
Toronto, Ontario Toledo 1, Ohio

\*Under 35mv/m from 540 k.c. to 150 m.c. at 50 ft.

Tune in "Suspense," Thursdays, 9:00 P. M., E. T., CBS

held in space, and were reflected, bent, and focused.

### South Carolina

Some 250 members and guests attended the August 31st meeting at the Columbia Hotel, Columbia, which featured Dr. J. O. Perrine's lecture on "Micro-Radio Waves in Civil and Military Communications." The audience included a large delegation from the Charleston Navy Yard, as well as Army personnel from Fort Jackson and representatives of the industry.

Officers elected to lead the chapter during its first year are: President—Fred M. Fister, South Carolina, Chief Engineer, *Southern Bell T & T Co.*; 1st vice-president—Capt. Joseph B. Berkeley, USN, Charleston Naval Shipyard; 2nd vice-president—Maj. Theodore A. Brunner, Post Signal Officer, Fort Jackson; secretary—John A. Norman, Division Construction Supervisor, *Southern Bell T & T Co.*; treasurer—Albert L. Ragsdale, Professor of Physics, University of South Carolina.

-30-

### DISC JOCKEYING AT THE PLAZA

An engineer's dream come true is the radio room of the Terrace Plaza Hotel in Cincinnati, Ohio, which keeps in operation throughout the day six radios, plus a seventh emergency hook-up. From 8:30 a. m. until 12:30 a. m., these six radios supply programs from Stations WLW, WSAI, WKRC, WCPO, WCKY, and the hotel's own recorded show, all of which may be tuned in by the guests by means of the six push-buttons provided in each room.

What makes the three men who staff the radio room very proud is the fact that the Terrace Plaza's own recorded broadcast is the one most often tuned in. One of the reasons for the popularity of the hotel's program can be summed up in the words "Extension 385." Guests who want a certain song broadcast at a definite time of the day, say as a "happy birthday" greeting in honor of a friend or "mood music" timed for romance, may dial 385, and the request is granted cheerfully.

Specially selected programs of music are used as a background for the many activities occurring there. Bright and airy music is selected for the breakfast hours, while more subdued selections and light opera herald lunch and dinner time. Vocals are seldom used, and bebop, swing, and hill billy numbers are out. George Gerishwin's "Rhapsody in Blue" and "Concerto in F" are popular request numbers. Frequently a guest will call up to learn the name of

a song being played and ask that it be repeated.

Three turntables are used to keep the recorded program going. Two are radio station types and one is a big automatic changer holding 100 records, that will play for 14 hours. There is no end to the variations possible with this arrangement. One turntable can be used for skating music outside, from early fall through spring, the second for the regular program, and the third for a special transcription to any location desired.

The seventh radio in this extensively equipped studio is used for emergency messages, and when it is broadcasting, every speaker in the hotel picks it up, even those that may be turned off at the time; the special message also cuts into any programs that may be on.

As impressive as the radio system may be, the plans for television facilities seem even more so. All the 19th floor rooms are wired for television, though guests now must supply their own sets. Later the hotel will have some available for rent. Plans are under way so that the Terrace Plaza will be able to present television shows on a channel received only in the hotel, emanating from the *Crosley TV studio* located on the seventh floor. When television can be controlled from a central station, the remaining rooms will be wired for it.

-30-

Herman Knott (right), head of the radio room staff at the Terrace Plaza, with an assistant, Everet Frady, prepares one of the hotel's recorded musical programs.





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THE LOWEST PRICE!  
CHECK THE R&M  
Bargain Bulletin**

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STANDARD  
& SURPLUS  
EQUIPMENT**



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Just drop us a card to get the Bulletin regularly. It gives you the real low-down on the latest competitive prices on surplus gear, plus special buys in nationally known standard AM FM TV and electronic parts. IMMEDIATE SHIPMENT! MONEY-BACK GUARANTEE!

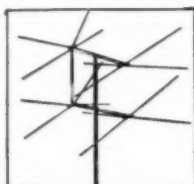
Typical Values Below:

**CATALOGUES GET OUT OF DATE TOO FAST! USE R&M BULLETIN AS YOUR BUYING GUIDE.**

## TV CONICAL ANTENNA

**STANDARD—\$9.95**

**DELUXE—\$13.29**



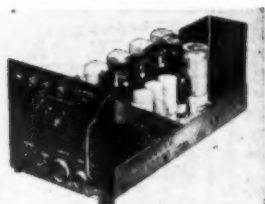
Unsurpassed in Performance! Conical stacked array and reflectors; all bands; less mast for 72 or 300 ohm; good up to 125 miles.

## 160 METER RECEIVER

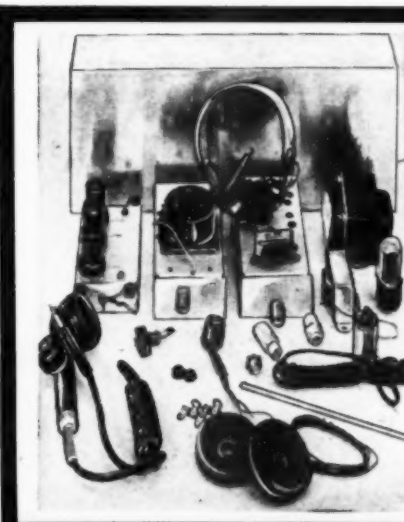
**HI-VOLTAGE POWER SUPPLY  
FOR 110 VAC—60 CYCLES OPERATION**

**\$14.95**

with these  
desirable  
features:



4 channels on 160 meters . . . Select your day-and-night freqs. by easy switching; 150 mil, 300 VDC .01% regulated power supply; two hi-voltage scope supplies, both 1350 VDC 2 mils, which combine to produce 2700 VDC at 2 mils; converts in 45 minutes. By presetting the 4 channels, you're prepared to receive on the old favorite 160 meters. Moreover, you'll have a power supply from 200 to 325 VDC at 150 Ma, continuously variable, with extremely low ripple content, .01% voltage regulation electronic control. Conversion is simple—consists of adding a pot for receiver gain control, a small audio output transformer and one half-watt resistor. Complete, simple instructions furnished with each set.



## CITIZENS RADIO

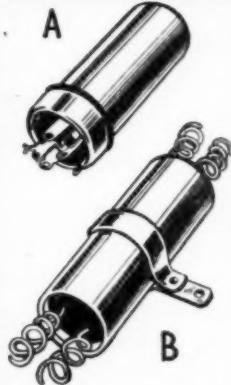
**AM-FM Transmitter & Receiver  
Offered for First Time  
at Ridiculously Low Prices**

**COMPLETE KIT  
Nothing Else  
to Buy**

**\$49.95**

Here's a sensational R&M offering—a compact kit for complete citizen frequency coverage on both AM and FM. Major components are pre-wired. Simple, easy-to-follow instructions and diagrams are furnished with each unit. Transmitting and receiving antennas are included. Operates on 110 VAC—60 cy. Useful for businessmen, doctors, sportsmen, boat owners, experimenters, hams, and first aid crews.

**A**



**B**

## FILTER CONDENSERS!

**FRESH STOCK • MONEY-BACK GUARANTEE**

Type	Mfd.	Voltage DC Working	Dimensions (Diam. x length)	Price (each)
A	40	450	1" x 3"	45c
A	40-40-20	150	1 1/8 x 2 1/8	49c
A	200	10		
A	80-40	150	1 x 3	55c
A	20	25	1 3/8 x 2	49c
A	40-20-10	150		
A	80-40-30	150		
A	100	25	1 3/8 x 2	66c
A	40-40	150	1 x 2	43c
B	20-40-20	150	1 x 3	39c
B	20-30-40	150	1 1/4 x 2 1/2	45c
B	4	450	1/2 x 1 3/4	19c
B	40-40-40-10	150	1 1/8 x 2 1/8	69c

Many more varieties not listed. Write for complete listing of condensers, resistors, transformers, speakers, etc. Any condenser order of \$10 or more shipped prepaid.

**TERMS: F. O. B. Arlington, Va. Under  
\$10—cash with order. Over \$10—25%  
deposit; balance C. O. D.**

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- A Blast-Proof, Blare-Proof Reflex Speaker with a Projector especially designed for use with the famous WESTERN ELECTRIC DRIVER UNIT.
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WILL HANDLE UP TO 50 WATTS  
WITH NO DISTORTION

#### EXCELLENT FOR:

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- SCHOOLS and
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25% Deposit  
With Order  
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**19<sup>95</sup>**  
F.O.B.  
N.Y.C.  
4 FOR \$75.00

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A fortunate purchase of genuine Western Electric Voice Coil and Diaphragm Assembly for the above unit at a close-out price.

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#### 3 SIMPLE OPERATIONS

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**NOISE LEVEL:** — 30 db minimum  
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Model LP-743 only **\$49.95** net

**REK-O-KUT CO., Inc.**  
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## International Short-Wave

(Continued from page 69)

ing SWL's who have v.h.f. interest.

### This Month's Schedules

**Algeria**—Radio Algerie noted on 9.57 to 1800 closedown; should be using winter channel of 11.835 soon? (Slut-ter, Pa.)

**Andorra**—Radio Andorra, 5.980, heard in Australia 1700 with French news and musical program. (Sanderson)

**Anglo-Egyptian Sudan**—"Omdurman Calling" heard on 9.750 on Fridays beginning with "Colonel Bogey March" at 1230 followed by call, "Good evening, everybody. This is the Sudan broadcasting from Omdurman on 30.5 and 49 meters short-wave and on a medium-wavelength of 524 meters." News in English, then musical program to 1300. Pearce, England, who reports this transmission, says: "I cannot hear anything of the 49-m. channel; letter states the station broadcasts on 6.122 and 9.770 s.w. and on 572.5 kc. m.w.; is reported heard in England on 5.940, but I cannot confirm."

The daily 2315-2345 Arabic transmission on about 9.750 is again being heard in the United States. (Belling-ton, N. Y., Stark, Texas, and others)

**Angola**—CR6RL, 9.47, Luanda, logged in New York 1545-1600 sign-off; played classical and tango music; off with "A Portuguesa"; signal only fair with some CWQRM; all-Portuguese. (Bellington)

**Radio Clube de Benguela**, CR6RB, 9.165, R6 with classical orchestral music 1330 on a recent Friday; has classical music at this time one day a week; off 1400 with "A Portuguesa." (Pearce, England) Sent verification and listed schedule of 0615-0700, 1230-1400 on 9.165 and 7.041; card is a pretty one with picture of elephant. (Fellers, Japan)

**CR6RG**, "Radio Diamang," 8.242, Dundo, heard weak a few times 1330-1430, through severe CWQRM; best during last half hour of transmission; programs are nice, consisting of music with many well-known melodies; verifies both by QSL card and letter; on Sundays has a broadcast 0300-0400 and not at 1330-1430. (Albinsson, Sweden)

"Radio Clube de Bie," 7.550, Silva Porta, heard to 1500. (Nattugglan, Sweden)

**Argentina**—LRS, 11.88, noted with excellent level, little QRM, at 1835 ending news bulletin; continued in English with SRI (International) programs. Mesquita e Sousa, Portugal, notes that this one verified from Radio Splendide, Ayacucho 1556, Buenos Aires, Argentina.

LRS, 11.88, and LRY, 9.451, are both heard in Sweden around 1900-2100; sometimes fade badly. (Gimby)

**Australia**—VLA4, 11.85, is a great improvement over VLA8, 11.76, which it replaced for the 1643-1815 beam to

**RADIO & TELEVISION NEWS**



Eastern North America; only interference is a slight heterodyne from Chile underneath VLA4. (Bellington, Osterman, N. Y., and others) This one is heard fair in Britain. (Pearce)

**Austria**—KZCA, Salzburg (U. S. Zone), heard on 9.535 around 0740-0800 when this call is given—"Blue Danube Network, Station KZCA, Salzburg." **Radio Vararlberg** (Dornbirn?) in the French Zone, 6.005, often is heard in Britain around 1600-1700 with invariable heterodyne; this station transmits the American-recorded religious program, "Bringing Christ to the Nations," in *English*, each Wednesday 1700. (Short-Wave News, London)

**Rot-Weiss-Rot**, 9.565, Salzburg, heard 0030 with "early morning music"; details and schedules 0056, followed by news in German 0100; more music 0115. **Radio Wien**, 11.785, Vienna, R6-7 signing on 0040 daily with church bells and recording of Handel's "Largo." (Pearce, England)

**Balearic Islands**—Radio Menorca, Mahon, heard 1330-1530, much QRM and CWQRM; frequency now appears 7.495-7.500, is well on the low side of EAJ43, Tenerife, Canary Islands. (Pearce, England) QRA is ERM, Delegacion Insular del Frente de Juventudes, Mahon, Islas Baleares, Espana (Spain). (DX Radio, Sweden)

**Bechuanaland**—Via airmail, Ridgeway, South Africa, writes—"As far as I know, Bechuanaland has but one station, ZNB, Mafeking, 5.90. Schedule is now 1200-1430; ZNB is a postoffice transmitter; formerly had a mid-day session but this has not been heard lately. Relays news from SABC, Johannesburg, at 1200 and then plays recordings to closedown."

**Belgium**—Ruyselede, 17.845, heard a recent Sunday 1115 to sign-off 1225, relaying soccer scores to Leopoldville in French; no announcement at sign-off, but from time to time said, "Allo, Leopoldville." (McPheeters, N. Y.)

**Brazil**—ZYS8, Manaus, now on 4.805 where is free of interference; heard in Australia opening 0500. (Simpson via *Radio Australia*)

**Radio Nacional**, Rio de Janeiro, was to have a new outlet on 6.155 shortly, may be on by now? (Osterman, N. Y.)

**British Guiana**—ZFY, about 5.985, Georgetown, is fair level evenings. (Slutter, Pa.)

**British New Guinea**—Officials of VLT7, 9.52, say program 0230-0300 is in *Pidgin English* (at times also uses Motu), and that bagpipes are used on VLT7 because the natives like the bagpipe tunes; asks for further reports. (Bellington, N. Y.)

**Bulgaria**—Radio Sofia, 7.671, news is radiated 1520, 1645; announces, "This is Radio Sofia, calling in the Anglo-American Service of the Bulgarian Broadcasting System." After the news, requests reports from listeners which says will be acknowledged over the air and QSL'd by card also. (Patrick, England) Heard with poor signal in Pa. around 2315 with setting-up exercises, still going 2345. (Hankins) Saturday sign-on is 2325, other days 2255.

November, 1949



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ATTEMPT REMOTE  
INSTALLATIONS -**

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**because**

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**are performance-proved**

**Up to 200 miles over land and up to  
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For both remote or high signal areas, Telrex Conical Window Mounts, Stacked Bi-Directionals and Stacked Arrays are the antennas dealers and service men can depend upon for consistently good results. Each type is thoroughly engineered in the laboratory, service-tested in the field and built for long service life. Using Telrex Conical Antennas on every installation is one sure way to better, brighter pictures and a minimum of service call backs. Ask your distributor for catalog or write direct outlining your antenna problems.


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MODEL 1X-BD**



Bi-Directional Hi-Gain  
Conical "V" Beam  
Broad Band Full Audio  
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Low Vertical Angle  
Non-Varying Center Impedance  
2 to 1 Front to Back Ratio  
Uses 72, 150 or 300 Ohm  
Transmission Lines  
Universal Mounting Clamp

**TELREX MODEL 2X-BD**




Bi-Directional Stacked  
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Low Vertical Angle  
Extremely High Signal to  
Noise Ratio  
Constant Center Impedance  
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Transmission Lines  
Universal Mounting Clamp

**FOR THE ULTIMATE IN BI-  
DIRECTIONAL GAIN, USE  
TELREX MODEL 4X BD.**

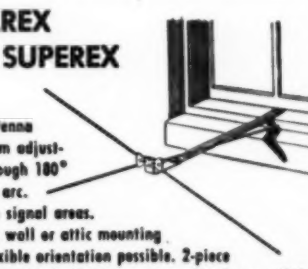
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Broad Band—Full  
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Band Pass  
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Minimum Reflections  
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4 to 1 Front to Back  
Ratio All Frequencies  
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**TELREX  
SUPEREX**



With antenna  
angle arm adjust-  
able through 180°  
azimuth arc.  
For high signal areas.  
Window, wall or attic mounting  
with flexible orientation possible. 2-piece  
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OUTSTANDING  
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MA-1619...\$6.95

Remote Control Equipment RC-261. Either main or remote unit pictured above may be used to operate, modulate or monitor radio sets. Interphone provided over the two units over distances up to 1/2 mile! Everything brand new and in original packaging; includes instruction books for operation and maintenance and extra-strong canvas carrying case for which you'll find a multitude of uses. Set contains sensitive 4 ma plate load relay, cords with PL-68 and PL-55 plugs, sealed audio transformers, other fine parts. Required for operation but not supplied are inexpensive T-17 microphones, headsets and 12 volts DC from ordinary flashlight cells. Main unit measures 8 1/2"x4 1/2"x4 1/2"; remote measures 7"x3 1/2"x5 1/4". It's a bargain for hams and experimenters! Limited quantity available.

## T-17 MICROPHONES

MA-1601...69c

Famous T-17 carbon mike with built-in hiss filter. Push-to-talk button in handle; 5-foot rubber-covered cable with PL-68 plug. Used but reconditioned and a great buy at our rock-bottom low price. Great for amateur mobile equipment, PA and for use with RC-261 above.



## TINY 60 RPM SYNCHRONOUS MOTOR

MA-1723...\$1.89

Used by model makers, display manufacturers, etc. Turns at 60 RPM with 26-35 volt, 60 cycle input. Operates from 110-120 volt AC with transformer we supply. 1 1/2" deep with 1 1/4" diameter; has 1/2" shaft 1" long. Made by Cramer and worth far more than our low price for both units.



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Rated 25 watts with extended frequency range to 10,000 CPS. Matches speaker voice coils from 3 to 15 ohms with line impedances from 50 to 6400 ohms in eight steps; further variations possible by paralleling taps. Widely used in line or plate to voice coil circuits. Shielded and hermetically sealed; measures only 3"x2 1/4"x1 1/4". Excellent for set-builders, servicemen, experimenters, etc.



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265 KC for auto sets. 2 1/2" high, 1 1/2" square. Spade lug mounting. Color coded leads.  
MA-502235—Input 29c Matched  
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455 KC standard. 3" high, 1 1/2" sq. Spade lugs. Coded leads. Input IF with grid cap lead.  
MA-502222-23—Matched 455 KC-IF pair, only 49c

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50 of One Type for 3.49  
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.000015	.00004	.00012	.0007	.0033
.000018	.000047	.00022	.0008	.006
.00002	.00006	.0003	.001	.0068
.000025	.000068	.00068	.002	

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Chicago 16, Ill.

Burma—Rangoon, 6.035, has news yet 1000, good signal. (Fellers, Japan.)

Canada—Cushen, N. Z., says VED, 8.265, Edmonton, Alberta, beamed to Yukon and Northwest Territories, is now scheduled 0900-0200 Monday-Saturday and 1000-0200 Sunday. (Radio Australia.)

CENX, 5.970, St. John's, Newfoundland, heard with news 0530, then music, fair signal. (Osterman, McPheeters, N. Y.)

CJCX, 6.010, Sydney, Nova Scotia, good signal in New York 1700. (Leinbach) CHNX, 6.130, is asking for reports to P.O. Box 400, Halifax, Nova Scotia, Canada. (Slutter, Pa.) Heard in Puerto Rico signing off 2315. (Novomestky)

CBX, 15.090, Montreal, is located at Vercheres and operates daily 0700-2400; power 7.5 kw. CBRX, 6.160, Vancouver, British Columbia, lists power as 150 watts. (Hubbard, N. C.)

Canary Islands—EJ43, Radio Club de Tenerife, 7.518, strong 1600-1700 (will be 1700-1800 soon when goes on winter schedule). (Pearce, England.) Is heard best in Sweden during the last half hour. (Albinsson.) Albinsson lists frequency as 7.540-7.550.

Ceylon—Radio Ceylon, 15.12, excellent in East 0600 with BBC news; also good 0700 when relays BBC's "Half-Hour in English for People in the Far East."

The 21.62 channel heard 0500 in Australia with news, then dance program. (Sanderson)

Verified by letter signed by J. F. Mudie; now using 21.62 directed to Malaya and Netherlands East Indies with 7.5 kw., and 15.12 beamed to North China-Japan with 100 kw.; schedule appears 0325-1205 on both; this is "basic schedule," so there may be other (unlisted) items. (Osterman, N. Y.)

Chile—CE1180, 12.003, Santiago, heard in Sweden 1800-2100, usually through heavy CWQRM. (Gimby)

China—At the time this was being compiled, Chungking, 11.913, was audible but weak in West Virginia 0800 with news; appeared to be jammed by

unmodulated carrier in addition to suffering usual severe CWQRM. The 15.17 channel—which should have news yet 0600—has not been audible here lately. The 11.913 channel has been heard in California by Raith at 1000 on a Sunday with news and then music dedicated to listeners.

Recently, a new station has been heard on 9.74 from 0520 sign-on to sign-off around 1005; all-native as far as heard; starts with march similar to that used by BEA8 (Nanking, 9.73, Communist-controlled outlet), followed by three chimes, then woman talks most of the time; location unknown; signal averages fair. (Balbi, Calif.) Also reported by Dilg, Calif., who says this definitely is not BEA8 which is heard just below the new one, but it may be Hankow (moved from approximately 11.495?).

BCAF verified from Major C. Y. Chen, Director BCAF, Taipei, Formosa; stated the 8.990 channel has been suspended and the station is back on 11.680; transmitter is a Wilcox 960 obtained from U. S. war surplus, output is about 3.5 kw.; schedule is 1700-1800, 2155-2400, 0330-0930 on 910 kc. and 11.680. (Cushen, N. Z., and Sanderson, Australia.) Heard 0515 with Western music, news in Chinese. (Sanderson)

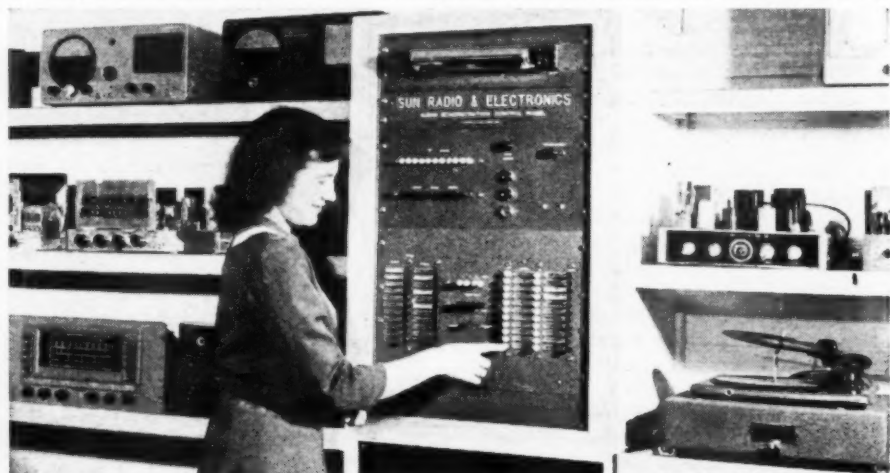
BEF8, 15.17, Chungking, heard 0500 with "Back to the Bible" session, news, and music. North China, 7.50, heard 0530 with Chinese news (slow speed), then music. Nanking, 9.73, heard 2005 with Chinese news and music (this may have been transposed, if so meant 0505). (Sanderson, Australia)

Communist-controlled stations continue to carry English news 0830 on announced 10.26 (Peiping), 9.73 (Nanking relay), 9.04, 7.50, 7.10, 5.98 (Nanking relay), and BCB 680 kc., all heard well in Tokyo. (Fellers, Japan)

A station heard mornings on about 11.685 to 11.700 (old Shanghai frequency) is believed to be Shanghai; does not take the Peiping (English) news 0830; heard to after 1000. (Dilg, Calif.)

A Chinese station has recently been

Recently installed in Sun Radio's Sound-TV Studio is a self-service, push-button panel permitting the customer to compare ordinary and high-fidelity sound reproduction in as many as 2600 combinations of audio components without moving from the instrument.







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FT-243 holders, 1/2" pin spacing, fractions omitted.

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6040 6840 7925	5675 5825 6000 6540 7206 7640
6073 6873 7940	5677 5840 6273 6373 7240 7673
6075 6906 7950	5700 5850 6340 6406 7306 7706
6100 6940 7973	5706 5873 6373 6440 7340 8000
6106 6973 7975	5725 5875 6406 6673 7373 8040
6140 7040 8240	5740 5900 6425 6706 7406 8050
6150 7073 8273	5750 5906 6440 6806 7473 8100
6173 7086 8306	5760 5925 6450 6806 7473 8100
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**49c EACH** 10 for \$4.50 **99c EACH** 10 for \$9.00

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**49c each**

<b>Crystal Frequency Standards</b> 98.356Kc Easily altered for 100Kc Standard. Mounted in low loss 3 prong holder. <b>\$3.89 each</b>	<b>For Crystal Controlled Signal Generators</b> FT241—525Kc 526.388 533.333 537.500 527.777 536.111 538.888 529.165 530.555 531.944 <b>99c each</b>
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<b>CRYSTALS FOR SCR 522</b> 5910Kc 7480 6370 7580 (45) 7810 6610 7930 735) <b>\$1.29 each</b>	<b>CRYSTALS FOR HAM USE</b> Fit 243 Holder 1/2" Spacing 3735 Kc. 69c 4190 Kc. 39c 5030 Kc. 39c 6485 Kc. 39c	<b>Crystals from BC 6 10</b> Spacing—2 Banana Plugs 2045 2305 3202 3550 2105 2320 3215 3570 2125 2360 3237 3580 2145 2390 3250 3945 2155 2415 3322 3955 2220 2435 3510 3995 2258 2442 3520 2260 2532 2282 2545 2300 2557 <b>\$1.29 Each</b>
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2B7 59 6SF5 60 12SK7GT 49 954 50	2S/4S 49 6SH7 72 12SQ7GT 54 955 55	5V4G 88 6S7GT 49 12SR7 72 957 55
6A6 88 6V6GT 72 14A7/12B7 88 16L9 55	6AE6G 72 6V7G 49 31 88 *VR53 19	6B4G 1.06 7A4 72 32L7GT 59 *Use to replace
6B7 59 7CS 72 35W4 45 12K7 or 1217	6C5 60 7H7 40 38 72	

Mixed quantities in lots of 100—10% discount from these prices

**HEADPHONES:** HH-4 High Impedance with long rubber cord and plug. \$2.49

**PHONO ARMS:**  
American model No. 1-J with CR 1a 3.5 volt output cartridge. Unboxed. NEW \$1.65  
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**SUN RADIO**  
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heard mornings on about 11.492; definitely is not Hankow and is Nationalist-controlled; heard from before 0800 and until around 0900; has played American recordings at times. (Dilg, Calif.)

Colombia—HJCX, 6.027, Bogota, "La Voz de Colombia," good signal from 2200; all-Spanish. (Osterman, N. Y.) HJEX, 6.054, Cali, heard identifying 2100; all-Spanish. (Leinbach, N. Y.) HJDE, 6.145, "La Voz de Antioquia," Medellin, has schedule of 0900-2200;

heard 1930 to sign-off; no English noted. (Novomestky, Puerto Rico)

Radio Nacional de Colombia seems to have taken over Radio Manizales, 6.225; goes to at least 2200 (this is not HJCF, 6.240, Bogota). (Stark, Texas.)

Kane, Pa., comments—"HJKD, Emisora Nuevo Mundo," is one of the stations in the QRM crazy-quilt on 6.000, but is in clear late evenings.

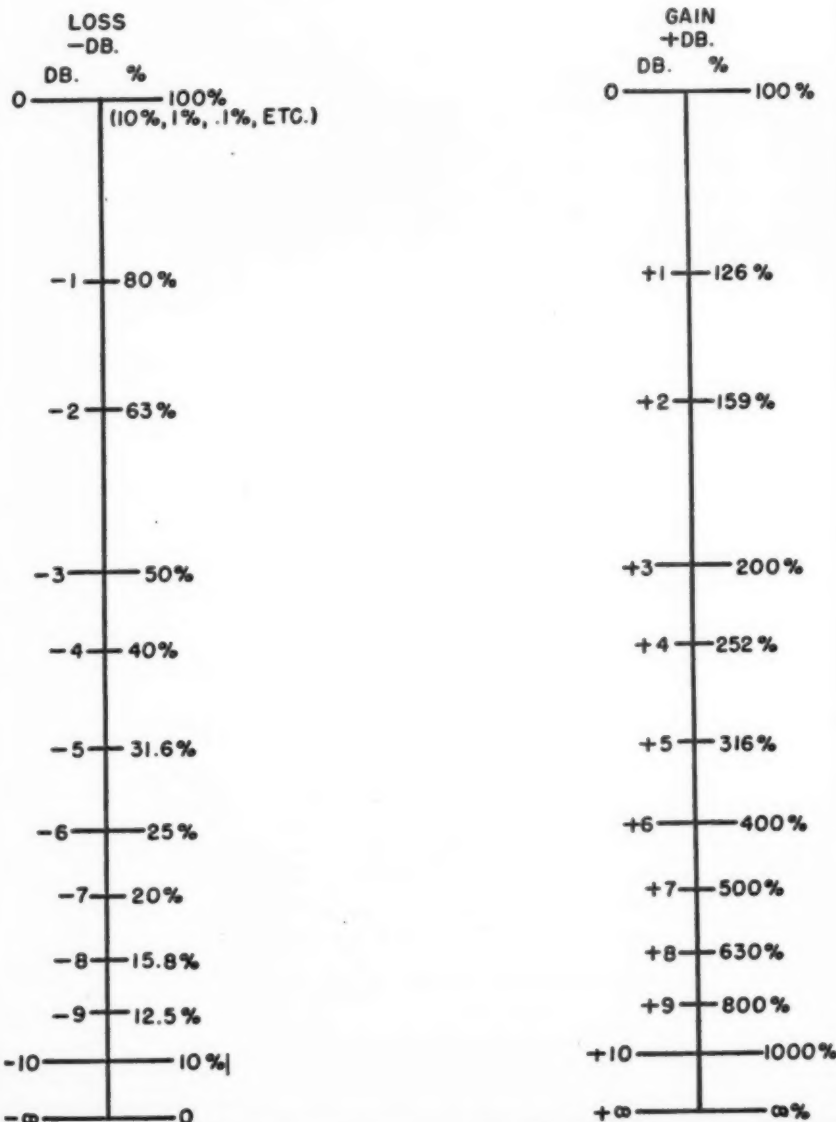
Cuba—COBZ, 9.035, Havana, noted with Spanish-English lesson Saturdays 1800. (Bellington, N. Y.)

## DECIBEL TO PERCENTAGE CONVERSION

By **GEORGE P. KEARSE**

Senior Eng., American Phenolic Corp.

This chart indicates the percentage gain or loss corresponding to the decibel gain or loss of an audio or radio frequency network. For example, if a network has a loss of 7 db., the output of the network will be 20% of the input. Similarly, if an amplifier has a gain of 9 db., the output will be 800% of the input.





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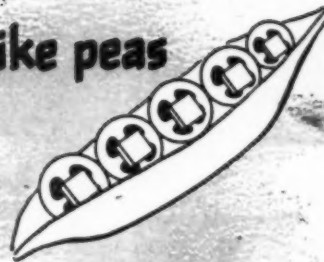
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## G. E. CHOKE

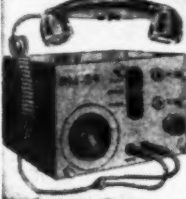
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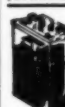
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BA 38	Walke Talkie, 103 1/2		1.00
BA 40	90 V., 11 1/2 V.		50c
BA 41	60 V., 25 1/2 V., 4 1/2 V.		50c
BA 48	90 V., 1 1/2 V.		5c
BA 59	45 Volt		50c
BA 70	90 V., 60 V., 4 1/2 V.		50c
BA 80	90 V., 60 V., 4 1/2 V.		50c
BA 200 U	6 Volt		75c
BA 203 U	6 Volt		50c
BA 205 U	3 Volt		25c

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RHC, Cadena Azul, Havana, COCY, 11.740, opens 0628, closes 0100, usually makes closing announcement in *English* as well as Spanish; *Radio Progreso*, COBC, 9.380, opens 0630 and is believed to leave the air 0100, no *English* noted; *Radio Salas*, COBZ, 9.026, opens 0700, closes down 0100, no *English* noted. (Novomestky, Puerto Rico)

Curacao—PJC2, 5.010, Willemstad, heard in Dutch 2030-2100, good signal in New York. (McPheeters.) PJC1, 2.315, heard signing off 2315 with Dutch National Anthem. (Novomestky, Puerto Rico)

Cyprus—Sharq-al-Adna, Limassol, heard in Britain 1330-1400 in parallel on 9.650, 6.135, 6.790; program chiefly Arabic music. (Short-Wave News, London)

Czechoslovakia—Prague has *English* daily 1245 on 11.84, 1445 and 1645 on 9.55; this is in addition to the *English* portion of the daily North American beam on 11.84, when *English* starts off the broadcast. On 9.55, Prague begins a period in Spanish at 1800, identifies in that language as "*Radio Praga*." (Ormond, N. C.)

Denmark—OZF, 9.52, signs on to North America daily 2100 and signs off around 2215-2230, news 2145. (Driver, Ohio.) Copenhagen now plays the Danish National Anthem regularly at sign-on; melody is believed to be "Kong Christian Stod Ved Højen Mast" ("King Christian Stood Beside the Mast"). This is *not* the tuning signal but is the tune played *after* the Town Hall chimes are rung. The melody played regularly at sign-off is a Scandinavian song, "There Is a Beautiful Land." There are three Danish recordings that have been played frequently during the Copenhagen broadcasts—"The Champagne Gallop," "The Rooster Dance" from Carl Nielsen's "Masquerade," and "The King Christian IX March." (Worris, N. Y.)

Dominican Republic—HI4T/HI2T, "La Voz Dominicana," 5.970, 9.735, are scheduled to open daily at 0700; usually operate in parallel but lately HI4T has been coming on the air later in the day; closing time is believed 2400. At around 0645 will come on with the first seven notes of the Dominican National Anthem which phrase is repeated to 0700; these notes are played on a piano. (Novomestky, Puerto Rico)

Finland—The Finnish Radio is making extensive plans to cover the 1952 winter Olympic Games to be held in Finland. The name of the Finnish National Anthem (which is played on 15.19 at the end of the daily 2200-2400 transmission) is "Maamme Laulu" ("Our Land"); the opening announcement of this transmission in Finnish is "Tama Suomen Yleisradio. Tama Suomen Yleisradio." (Each "A" in "Tama" has an umlaut.) During this transmission on OIX4, 15.19, the first part has been devoted to programs in Finnish (dramas and concerts), and at 2320 they "anthem," announce "Finlands Rundradio! Finlands Rundradio!" and begin a program in Swedish



which continues to 2400 sign-off when they again "anthem." (Worris, N. Y.)

**French Indo-China**—According to a letter received by Kensy, Germany, from *Radio Chambodge*, Phnom-Penh, this station is operating on 6.090 with 1 kw. at 2300-0030, 1030-1600, 1800-1900; reports from listeners are welcomed. (Swedish DX broadcast)

**Radio Saigon**, 11.78, is heard in South Africa at 0900 with *English*; the 6.165 outlet carries an entirely different program (in French). (Ridgeway)

**The Broadcaster**, Perth, Western Australia, says Hanoi can be heard daily to closing 0830 on 8.640; on Sunday the closing time is 0645, the last 15 minutes being in French; says Viet Nam on 12.000 can be picked up daily 1915-0030, 0730-0830. Says *Radio Hue* in the province of Annam is being received on 7.210, having a power of 1 kw.; schedule is daily 1800-2000, 2200-0100, 0500-1030; reports should be sent to P. O. Box 65, Hue, Annam, Fr. Indo-China. Fried, Michigan, comments that this is a Viet Nam Republic outlet.

**French Morocco**—Radio Rabat, 6.006, heard 1430 with Arabic music; signals suffer CWQRM; again logged 1600 with announcement in French, "Ici Radio Maroc," followed by recordings, chiefly of French origin. (Patrick, England)

**French West Africa**—Kensy, Germany, received a letter from *Radio Bamako* which has an output of 2 kw. on 15.030. Is operated by the Government and is on the air irregularly; programs consist of meteorological reports, Government and industrial news, and now and then some music. (Swedish DX broadcast.) Is listed FGJ9, 15.025, 350 watts, and as "inactive."

**Radio Dakar** noted back on 11.895 after having been "missing" for a short time; heard again to 1800 close-down. (Stark, Texas)

**Germany**—Munich relays of the "Voice of America" are scheduled—Munich III, 6.080, 1015-1700 to Europe; Munich IV, 7.250, 1015-1715 to Europe; Munich II, 9.540, 1015-1700 to Europe; Munich IV, 11.870, 1015-1045, and Munich I, 11.870, 1230-1715 both to Europe; Munich I, 15.280, 1100-1200 to Middle East. (Legge, N. Y.)

Nordh, Stockholm, says he has been hearing a new German station on about 6.072 around 1640-1650; announces in German as *Mitteldeutscher Rundfunk Sender*, Heidelberg.

A newcomer to the *ISW Department*, Leary, Indiana, reports DHT, Germany, on 15.860-15.870 with newscast for recording to America 1600-1615, good level.

**Radio Stuttgart**, 6.050, 10 kw., is on the air Mondays, Wednesdays, Fridays 0430-0745 and 0855-1700; Tuesdays and Thursdays 0430-0730 and 0855-1700; on Saturdays 0430-1700, and on Sundays 2300-1700. (Swedish DX broadcast)

**Greece**—Bluman, Israel, reports that Macronesio moved from 7.040 to 7.105. Transmitter heard 1200-1500 on 6.530-6.550 is not a Communist outlet

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2" 0-30 amp DC. 2.45	2" 0-100 ma. 3.50
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20 mfd 330 vac. \$1.85	2 mfd 1000 vdc. \$0.79
5 mfd 150 vac. .49	4 mfd 1000 vdc. .95
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4 mfd 600 vdc. .59	1 mfd 2000 vdc. 1.45
6 mfd 600 vdc. .79	2 mfd 2000 vdc. 2.25
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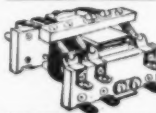
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5 Volt 15 Amp. ....	\$2.75
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2.5 Volt CT 21 Amp. ....	4.75
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### **MULTIPLE SECONDARIES**

5 1/2V CT 21A. 7.5V 6A. 7.5V 6A. ....	\$4.95
5 Volt 4A. 6.3V. 3A. ....	2.45
2.5V CT 20A. 2.5V CT 20A. ....	6.95
2.5V CT 10A. 10V 3A. 5V. 3A. 5V 3A. ....	3.95

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6 Henry 50 ma 300 ohms. ....	3 for \$0.99
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8 Henry 160 ma 140 ohms. ....	.99
1.5 Henry 250 ma 72 ohms. ....	.59
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4.3 Henry 620 ma 42 ohms. ....	6.95
Swing. Choke 1.6/12 1 Amp/100 ma 15 ohm. ....	19.95

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but is a new Greek State Transmitter; name sounds like Chios; heard by Skoog in Sweden to 1625 on a Sunday. (Swedish DX broadcast)

Guatemala—TG2, 6.621, Guatemala City, "Radio Morse," listed 1 kw., still heard 2115 tune-in and still going 2325; verified by nice card; all-Spanish. (Driver, Ohio.) TGLA, 6.295, noted recently on before 1915; used to go to 2205. Another Guatemalan outlet is being heard on about 6.230 (listed 6.234) with call TGJA, *Emisora Nuevo Mundo*; leaves the air 2200. (Stark, Texas)

Hawaii—Honolulu relays of "Voice of America" broadcasts are scheduled—KRHO, 15.250, 0400-0915 to East Asia; KRHO, 17.800, 0215-0345 (Tue.-Sat.) to Philippines-E. Indies (UN); KRHK, 17.800, 0400-0915 to Philippines-E. Indies; KRHO, 17.800, 1700-1900 to Philippines. (Legge, N. Y.) The "Amateur DX Radio" program is carried on 15.250 on Sundays 0800-0815; forecasts reception conditions. (Ferguson, N. C.) This program is carried also on other "Voice of America" stations (and relays) to the Far East.

Holland—Hilversum sent these current schedules—on PGD, 6.025, PCJ, 15.220, PHI, 17.775-21.480, *English* 0500-0600 (except Sun.); Dutch 0400-0600 (Sun.), 0430-0500 (first and third Mons.); Happy Station Program, 0330-0500 (Tues.), multiple languages; Dutch 0715-0830 (daily), 0830-0900 (daily but not on PCJ), 0900-1015 (except Sun.), 0900-1030 (Sun.); in Bahasa Indonesian 0830-0900 (daily on PCJ only); *English* 1015-1030 (except Sun.); Happy Station Program, 1030-1200 (Sun. and Wed.), multiple languages.

On PGD, 6.025, PCJ, 9.590, and PHI, 11.730, *English* 1230-1330 (except Sun.); Dutch 1230-1540 (Sun.), 1330-

1600 (except Sun. and Wed.), 1330-1530 (Wed.), Happy Station Program, 1600-1730 (Sun. and Wed.), multiple languages; Spanish 1730-1830 (except Sun.); Dutch 1745-2130 (Sun.), 1830-2100 (except Sun.); Spanish 2100-2130 (except Sun.); *English* 2130-2230 (except Sun. and Wed.), 2130-2200 (Wed.); Happy Station Program, 2200-2330 (Sun. and Wed.), multiple languages. (Worris, N. Y.)

Hungary—An English news bulletin is broadcast daily 1720 from both 6.247 and 9.820 channels of *Radio Budapest*, best on 9.247 in Britain. (Patrick)

India—VUD, 17.74 (may have meant 17.84?) is being heard on West Coast from 0630 to around 1100, with strong signal to 1030; also heard at 1930 to sign-off 2014, fair to weak. (Balbi)

AIR noted recently on 15.16 in parallel with 11.89 in the Indonesian period 1845-1900; 19-m. outlet was much the weaker. (Bellington, N. Y.)

The *Indian Listener* is now published weekly instead of fortnightly. It now "invites correspondence from readers on articles published and talks, discussions, and so on reproduced in the journal. Letters should be in *English*, brief and to the point, and should be addressed to the Editor, The *Indian Listener*, Curzon Road Barracks, New Delhi, India." First issue of *The Indian Listener* was back in December of 1935, and contained programs of only three stations—Bombay, Calcutta, and Delhi with one transmitter each. AIR now divides its services into (1) Regional Short-Wave Service, (2) National Home Service, and (3) Services for Overseas Listeners. The *Listener* recently carried excerpts from letters of AIR listeners in such widely separated areas as Norway, England, Sweden, Scotland, Germany, Persian Gulf, New Zealand, United States (Illinois), Saudi Arabia, Burma,



Radio hams handled a large part of the communications at this year's National Air Races. These operators, shown at one of the three control points, also served as a maintenance and repair group for the \$15,000 worth of radio equipment owned and, in many cases, operated by amateurs.



The parking and servicing of some 3000 visiting transient aircraft by the Civil Air Patrol at the Labor Day races was accomplished safely and rapidly with the assistance of mobile radio equipment loaned by the hams, creating an orderly operation out of what would have been chaos.



and Austria. These were from reports on "experimental services only," it was stated. Format and content of the journal continue to improve greatly.

**Indonesia**—By this time, YDC, 15.15, should be using the new 100 kw. transmitter at Batavia; watch for this one during the daily *English* beam 0600-0700.

**Makassar, Celebes**, around 11.085, is usually fair to good here in West Virginia at 0600.

A station heard mornings on approximately 9.685 is believed to be *Radio Sario*, Menado, Celebes, which has been shifting about in recent weeks. (Stark, Texas)

**YD12**, 4.366, Soerabaja, heard in dual with **YD13**, 7.293, mornings; latter is good signal. (Dilg, Calif.)

**Israel**—*Kol-Yisrael*, 9.000, Tel-Aviv, is widely reported in East with fair to excellent signals from 2245 sign-on (may sign on 2345 on Fridays). Heard very weak on West Coast by Dilg.

The experimental transmitter previously reported on 11.82 has moved to 9.000. (Bluman, Israel, via ISWC, London)

**Kol-Yisrael** will soon inaugurate an overseas service, using 7.5 kw. until the new 50 kw. transmitter—now under construction—is completed. Initially, there will be daily programs in *English* and Hebrew beamed to North America, as well as an expansion of the existing Middle East programs in Arabic, Turkish, and Persian. The 7.5 kw. transmitter has tested on 11.82, 9.000, and may also use any of 11.935, 15.415, 17.880, and 21.465 channels. Reports are welcomed by *Kol-Yisrael*, particularly from listeners in North America. (Bluman, Israel, via *Radio Australia*.) QRA for reports is *Kol-Yisrael*, Technical Dept., Hakirya, Israel. (Swedish DX broadcast)

**Italy**—Test transmissions by *Radio Italiana* in *English* and Italian have been heard in Stockholm on about 15.620 at 1345-1445. (Swedish DX broadcast)

Rome continues to use 15.12 (replacing 9.63) in the daily 1930-2055 transmission to North America, with 11.81 (Continued on page 180)



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November, 1949



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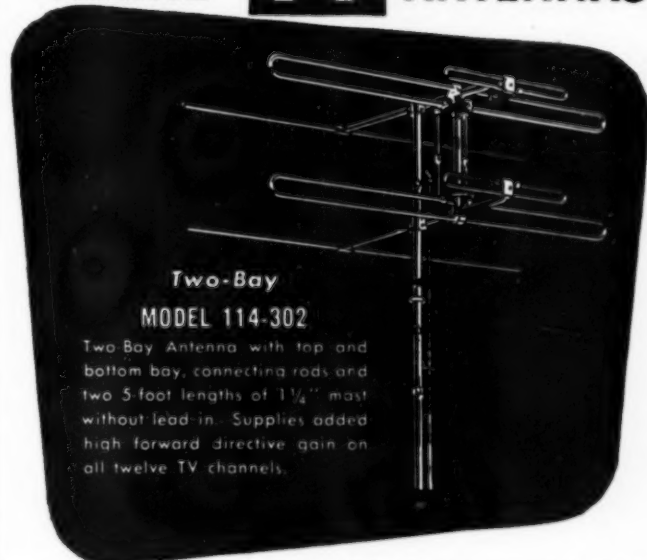
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TUBE CARTONS—Miniature (1 1/2" sq. x 2 1/2"). Per 100. . . . 98

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## Equalizing Phono Pickups

(Continued from page 65)

ciples, equalizers have been constructed for various commercial pressings. In every case, standard half-watt, 10 per-cent tolerance resistors were used, and the required condensers were built up from the miniature paper condensers now made by several manufacturers. Equalizer characteristics attained with such components are generally sufficiently close for all practical purposes. The characteristics can be checked with a signal generator of low internal impedance by placing a condenser of the same value as the cartridge capacitance in series with the equalizer input; the signal voltage should then be varied with frequency to correspond to the open-circuit output of the crystal cartridge.

With compact components of the type mentioned, the entire equalizer is conveniently inserted into a small shield can and potted in microcrystalline or ceresin wax. The cans in which 35 mm. photographic film cartridges are sold make excellent shields for this purpose. A series of such equalizers arranged on a rotary selector switch makes a compact and convenient means for correcting the various characteristics followed in commercial pressings.

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—30—

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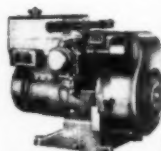


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RADIO & TELEVISION NEWS



## Amplifier Design

(Continued from page 41)

of multi-element tubes. "Class AB<sub>1</sub>" 6L6's under these conditions may undergo a twenty-five per-cent decrease in screen voltage under maximum drive, with a consequent loss of output and reduction in gain.

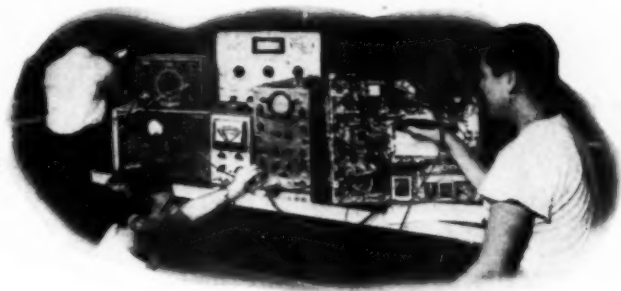
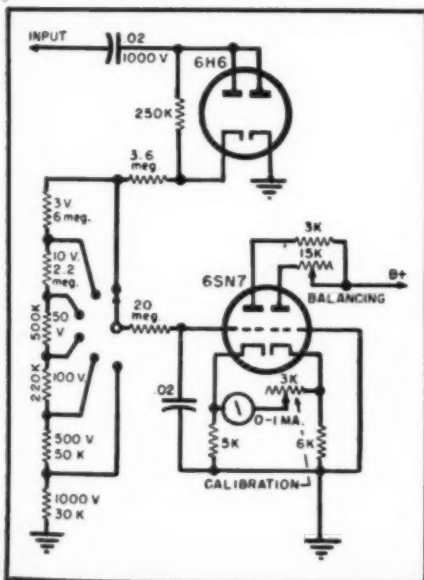
A good method for stabilizing amplifier operation is to use a small separate power supply for the screen grids, driver tubes, and fixed bias. As current requirements in this application are usually small, excellent regulation and very good decoupling may be obtained from the plate supply where wide current variations may occur. This is especially desirable in systems where it is wished to combine high gain with high output. The added cost is usually reasonable, as the only additional components required are a small power transformer, rectifier tube, and filter condenser.

Another method of screen stabilization is the use of voltage regulator tubes. A combination of tubes having a voltage equal to the screen requirements should be used.

Although the intermodulation measuring technique may be applied to any type of power amplifier, the preceding discussion has been concerned primarily with multi-element, or "beam power," tube amplifiers. Triode amplifiers have the advantage of low output impedance and tolerance to load variations as well as somewhat greater simplicity. Disadvantages are lower output and higher grid voltage drive. In general, the notes regarding fixed bias, voltage regulation, and decoupling hold for both types of amplifiers; however, the multi-element tube amplifier was selected for emphasis as being the most representative and popular of the various amplifier designs.

-30-

Schematic diagram of v.t.v.m.



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# In Estimating—Look for Hidden Labor Costs

By **HAROLD J. ASHE**

Tax Counselor

**Chamber of Commerce reports "hidden wages" run about 15% of employer's total payroll.**

**N**OW THAT highly competitive charges are returning to the radio and television service trade, a good many shop owners may need to take another long, hard look at their estimating methods, flat-rate charges, and service call rates and, in some instances, radically alter them.

There is considerable evidence to support the belief that the wide variation in service charges by different shops may be due less to cut-throating (although this is always with us) than a failure upon the part of many shop owners to consider all of the cost factors entering into servicing in homes or in shops. While shop owners can not be expected to understand the intricacies of cost accounting, some show a positive genius for ignoring the most fundamental service costs.

Not long ago the United States Chamber of Commerce underscored a situation which, we believe, has been given too little consideration by radio service shop operators. The Chamber, in a survey of private employers, has come up with startling evidence that there is a "hidden payroll" running close to 15 per-cent of the average employer's payroll. In 1947, this study points out, the typical worker received from his employer benefits totaling more than \$424, over and above his wages.

That is, in addition to the basic or generally recognized wage, the employer also bears additional wage costs in the form of old age and survivor's insurance, unemployment insurance, workmen's compensation, paid holidays, vacations with pay, year-end and Christmas bonuses, and numerous other benefits.

Quite by coincidence this 15 per-cent national average for all industries and trades approximates very closely the amount of hidden wages for the typical radio service shop. Is the shop owner recovering this \$424 additional wage in his service charges, or is it coming out of his own pocket in decreased profits?

It is the injection of this relatively new factor of large hidden wages that brings about serious discrepancies in estimating and determining flat-rate charges and points up the need for overhauling estimating techniques and pricing structures. A time was,

not so long ago, when the hidden labor costs were nominal and constituted only a small part of the shop owner's overhead and might, without harm, be lumped in as general overhead. Now, these hidden labor costs, if not treated as part of the cost of labor and so identified, loom large in the overhead aggregate.

Careful estimating and pricing now insistently demand that itemized social security, workmen's compensation, and unemployment insurance taxes be added to the basic wage in determining the over-all wage factor. These extra labor charges should not be lumped under general overhead which, properly, should be a catch-all only for such costs as cannot be accurately charged directly to specific jobs.

However, with social security, unemployment insurance, and workmen's compensation now constituting only part of the present hidden labor costs, it would seem equally imperative to also charge other hidden labor costs directly to labor in estimating and pricing. Once the shop owner knows what his other hidden labor costs are running him, he can use a percentage formula to arrive at a dollars and cents figure on his wage factor.

Because the labor factor is a variable, no matter how slight, it is a basic accounting and estimating error to add any of the hidden labor costs to the job by a percentage formula of the *material and labor costs*. It can be pinned down and be expressed more accurately by using the percentage formula directly to labor only.

With all hidden labor costs running from 12 to 15 per-cent of the payroll, there is grave danger in lumping any part of these hidden labor costs into the catch-all of general overhead. If on a job where material is high in relation to labor, having hidden labor costs in the overhead will over-state the hidden labor costs in the estimate or price. Contrary-wise, if the labor factor is high in relation to materials, and hidden labor costs are in the overhead, there will not be enough of an overhead charge to recover the outlay for hidden labor costs.

In one case, the estimate or price may be unjustifiably high, and the shop may lose the job or, if it does get





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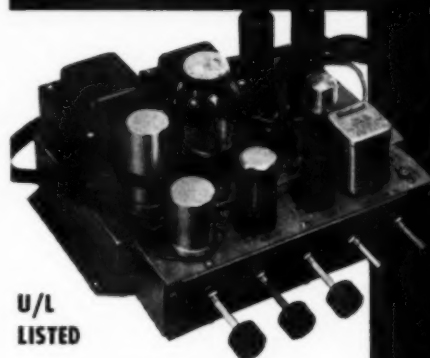
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What a buy! You get the famous Approved 1 tube AC-DC superhet broadcast tuner that is completely filtered and hum-free. You get a superb Elanco 4 tube high fidelity amplifier providing full coverage from mellow bass to crisp treble. You get a standard brand 12" PM Alnico speaker with excellent response. Hook 'em up for home or public address use.

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110 Volt 60 Cycle Primary  
6.3 volts C.T. @ 1 amp, 2500 v. insulation \$ .89  
6.3 volts C.T. @ 3 amp, 2500 v. insulation 1.39



### EICO SIGNAL GENERATOR KIT

150 Kc to 34 Mc on fundamentals, up to 102 Mc on strong harmonics. 400 cycle audio sine wave for audio testing and R. F. modulation. Ask for KIT MODEL 320-K. \$19.95  
MODEL 320, as above, assembled, factory wired and aligned... \$29.95

### POPULAR SERVICE MANUALS

Speed up repairs. Clearly printed circuits, parts list, alignment data, and service hints help you earn more per hour.  
Most Often Used Television Service Information (1948) or (1949), Supreme Publishers, Each ..... \$3.00  
Television and FM Receiver Servicing, Milton S. Kiver ..... 2.89  
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Radio Data Book, Boland & Boyce ..... 5.00  
Video Handbook, Boland & Boyce ..... 5.00  
(Both Radio Data Book & Video Handbook) ..... 9.00  
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Studio Microphones  
at P.A. Prices

Ideal for  
BROADCASTING  
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PUBLIC ADDRESS

"The ultimate in microphone quality," says Evan Rushing, sound engineer of the Hotel New Yorker.

• Shout right into the new Amperite Microphone—or stand 2 feet away—reproduction is always perfect.

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Model KKH, list \$18.00



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it, gain a dissatisfied customer; on the other hand, it may be too low, and the job will be done at a loss.

While the shop owner is mindful of social security, workmen's compensation, and unemployment insurance taxes because they are tied directly to the payroll week by week, he is less likely to be aware of the heavy drain on his business traceable to the so-called fringe benefits. These may include, by union agreement, as many as six or seven paid holidays a year, as well as voluntarily given paid vacations for older workers and, perhaps, distribution of Christmas bonuses or year-end gifts. In addition, an increasing number of shops are covering their regular employees with life and sickness insurance and pay all or part of the premiums. All of these added costs are part and parcel of hidden labor costs.

Assume a service technician is paid \$2.00 an hour, and, to simplify this illustration, assume he is employed steadily throughout the year. Thus, he is employed 40 hours a week, 52 weeks a year, for a total wage of \$4,160. During the year he is paid for 2,080 hours. However, he gets paid for six holidays a year, so there are 48 hours (better than a week) in which he does no productive labor, but draws full pay. So, in fact, the basic wage in relation to productive hours is better than \$2.04 an hour for each of the 2032 hours worked during the year, or two per-cent greater than appears to be the basic wage.

While this added two per-cent may not appear to be considerable in relation to either the total payroll or the total volume of business, if it is not recovered from or charged to the jobs it will decrease profits.

If one week's vacation with pay is given, this boosts the basic wage for productive work still further, as does the payment of insurance premiums on life and sickness policies. Even a modest cash bonus at year-end of \$25 can increase the basic wage by one-half of one per-cent. And so it goes.

From this, it can be seen that today even those shops which pay only for such hidden benefits as are required by law or union agreement have a hidden labor cost burden of upwards of 10 or 12 per-cent.

In fact, where paid holidays are in union agreements or are voluntarily given, the shop operator pays hidden benefits on hidden benefits, pyramiding the costs. That is, he pays hidden benefits in wages for time not worked, and then he pays workmen's compensation, social security, and unemployment insurance on such wages.

To ensure the likelihood that such hidden labor cost be recovered, the shrewd shop owner might very well weigh the advisability of directly relating such hidden labor costs to the basic labor wage in establishing rates for service calls, estimating repair jobs, and revising his flat-rate charges.



## Mae's Service Shop

(Continued from page 68)

paper where some lodge, group of factory workers, political group, etc., is going to have a gathering. I immediately get in touch with the chairman of the committee on arrangements and suggest I furnish him with a good sound installation. Another good source is the list of park reservations that I get from the park superintendent. I write to the party who has made the reservation for a family reunion, picnic, home-coming, etc., to see if he could use an amplifier. A lot of them can, now that you mention it!

"The whole idea is to keep alert to the need for amplifying equipment. Last summer, for example, I loaded my equipment into the truck and drove out to the county fair. Practically every carnival outfit on the midway had an amplifier of one sort or another, and just about half of them were prospects for either sales or service. I sold three complete amplifiers out there and got at least a dozen service jobs."

"Well, how about the service end? Do you need much special equipment?"

"A really well-equipped radio service shop needs very little extra equipment. You must have a good, low-distortion, variable frequency audio oscillator; you should have an up-to-date amplifier service manual; and it is very convenient to have a distortion analyzer and an output power meter. This last item is very handy because it has built-in load resistors that will match every power amplifier output impedance. With it attached to the output and with a 400 cycle signal input, you can instantly see the effect of replacing a weak tube, etc. What is more, you can do your checking of the amplifier in silence. However, you can still use the v.t.v.m., scope, and an assortment of husky loading resistors to the same end."

"What do you do to give an amplifier a complete check?"

Mac reached up and pulled a red-jacketed book from the shelf.

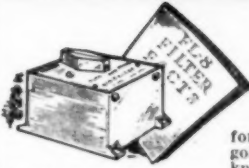
"Here is the sound man's most up-to-date 'bible,'" he said. "Take it home and read it. It is Read's 'The Recording and Reproduction of Sound.'" He says—and I agree with him—that the following tests should be made in this order:

1. Tube checking
2. A.f. signal tracing
3. Static voltage and current measurements
4. Gain measurement
5. Frequency response check
6. Distortion check
7. Check for feedback
8. Impedance measurement
9. Power output measurement
10. Hum and noise level checks

"After you have been through an amplifier with that fine tooth comb,

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booklet .....  
Booklet alone (prepaid in U.S.A.) ..... \$2.98  
\$5.00

### HOT SPECIAL ON OIL CAPACITORS

8 mfd. 1000V. Oil-filled. Aerovox. Rect. case complete with mounting brackets. \$1.95 ea. 5 for \$8.95  
4 mfd. 600V. Oil-filled. Round case, upright, single-hole mtg. with mtg. hardware... 95c ea. 5 for \$3.75



### HEAVY-DUTY FILTER CHOKES

A hermetically sealed unit, conservatively rated at 10 henries @ 200 ma. Has hum-bucking tap. Steel case—ONLY \$1.98 each.

### COMPLETE POWER SUPPLY—COMBO OFFER

1—Filter choke... (as above)  
2—4 mfd., 600V condensers, Oil-filled  
1—Power transformer, Pri. 110V, 60 cy. AC. Sec. 230V. AC. CT. @ 200 ma. 5V @ 6A. 6.3V @ 8A.  
1—5T4G rectifier tube  
All of the above items ..... only \$6.95



### HANDSET HANGER

Accommodate all makes and models, (Kellogg, W.E. American etc.) Beautiful, cast aluminum shell finished in rich black wrinkle. Felt facing protects handset. Provision to fasten directly to desk or to telephone equipment. An extremely useful, well-made item ..... \$1.95 ea.

### TS-10 Sound Powered Handsets

Brand New! \$16.95 per pair  
RM-29A TELEPHONE: Brand New ..... \$12.95 ea.  
EE-89A TELEPHONE REPEATER: New \$9.95 ea.

### LINE-FILTER KIT

Supplied with all necessary parts including chokes, capacitors etc. Mounts in an attractive stainless-steel box which comes completely drilled. Diagram is furnished. Anyone can quickly assemble the parts into an effective line filter that will handle 50 amp. (max.) ..... only \$1.95

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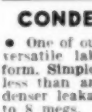


Here it is—at last! Just plug it into the rear of your 274-N RECEIVER... any model! Complete kit, and black metal case, with ALL parts and diagrams. Simple and easy to build in a jiffy. Delivers 24 volts plus 115 voltages. No wiring changes to be made. Designed especially for the 274-N receiver. All necessary parts for conversion of rest of receiver also included. ONLY \$7.95. TUNING KNOB for 274-N Receiver, 59c ea.



### SENSITIVE, 6500 OHM SP-ST RELAY

Made by Automatic Electric Co. Normally open, wiping contacts, relay is midsize and very light weight. Closes on 2 ma. Ideal for models and control. Only \$1.25 ea.; 10 for \$10.00



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LORD 8 lb. 7c ea., 8 for 45c; \$3.00 per C.  
LORD 10 lb. 15c ea., 8 for 98c; \$7.50 per C.  
HARRIS 8 lb. 8c ea., 8 for 45c; \$4.00 per C.  
HARRIS 12 lb. 16c ea., 8 for \$1.05; \$9.00 per C.



### LORD SHOCK MOUNTS

### W-E 703A GROUND-GRID TRIODE

High hop on UHF receivers. Fine signal noise ratio. Grid, (shell) bolts direct to chassis with rings. Only \$1.95 ea. or 4 for \$5.00.



### RCA 8012 VHF TRIODE

TANTALUM plate and grid! .35 watts output, 40 watts plate diss. Use as osc. or amp. at full ratings up to 500 mc! C.T., 6.3V filament reduces fl. lead inductance. ALL BRAND NEW! Normally sells for \$14.50, large quantity purchase permits our extremely low prices of \$1.90 each. 4 for \$5.00.

### VT-127A HIGH-POWER TRIODE

High-vacuum, rated up to 15,000V plate! Pair will handle 1 kw input on 6 meters. Use as amp. or osc. at full ratings up to 150 mc. Similar to 100TH but heavier filament. (5V @ 10A) Platinum grid. Only \$2.49 each.

### CATHODE RAY TUBES

3CP1, 3" C-R tube. Green, med. persist. screen ..... \$2.95  
3DP1A, 3" C-R tube. Green, med. persist. screen, 14 pin base for oscilloscope use. A real buy at only ..... 2.50 ea.  
3FP1, 3" C-R tube. Green, med. persist. 2.95 ea.  
3MP1, 3" C-R tube. Green, med. persist. 2.50 ea.  
5NP1, 5" C-R tube. Green, med. persist. screen ..... 2.50 ea.



### W-E 388A "DOOR KNOB"

Fil., 1.5V at 9 amps. Plate V. 500. Plate cur. 125 ma. max. Grid cur. 20 ma. max. Plate diss. 50 watts. Look at these UHF ratings! 12W at 400mc, 10W at 500mc, 8W at 600mc, 6W at 700mc, 2W at 800mc. A steal at \$3.99 ea.; or 4 for \$13.95

### W-E 316A "DOOR KNOB"

Smaller version of the 388A, 30W plate diss, 450V @ 80 ma. 7.5W output at 500 mc! Real tube value at ..... \$1.25 ea.

### HI-LEVEL NEGATIVE PEAK CLIPPER! 836 RECTIFIER TUBES

Use an 836 high-vacuum, high-voltage rectifier tube. Ideal for "clippers"—no "hash" troubles. Same tubes also used to replace 806's in normal, high-voltage rectifier applications. Rock-bottom price on a really "hot" tube 2 for \$1.10

High-voltage Filament Transformer for "Clipper" or Rectifier applications. Pri. 110V, 60cy. AC. Sec. 2.5V @ 10A, 10,000V insulation ..... \$2.76 ea.

954 and 955 acorns ..... .39 ea.  
815 twin tetrode ..... \$2.50 ea. 4 for \$4.90  
807 ..... \$1.12 ea. 4 for \$3.95  
6-203 Thyratron ..... \$7.97 ea.  
C-6A Teletype hi-amp rectifier ..... \$7.95 ea.

### 805 ZERO-BIAS, CLASS B MODULATOR

A pair of these will modulate 1 kw input to the final with 1200V on the plates, zero bias. \$4.25 ea.

### 810 HIGH-POWER TRIODE

The real powerhouse carbon-plate. A solid 1 kw per pair, or over 500W single, up to 30mc. BRAND NEW! \$5.95. 4 for \$21.95.

### 838 POWER TRIODE

100W plate diss. Full ratings to 30mc. 260W pair, Class B audio. .... \$3.50 each



### HY-615 UHF TRIODE

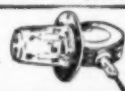
6.3V filament. 4.5 watts output. 98c each or 4 for \$3.00.

### HY-114B UHF TRIODE

Ideal for battery portable xmt. 2 watt output at UHF. 98c each or 4 for \$3.00.

### 2J-32 MAGNETRON

Frequency range, 2750-2820mc. 1 kw. Pwr. Out. 285kw. \$14.85 each.



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# 3 GREAT NEW TITONES

meet changing  
pickup needs!

NOW a full line of Titone's amazing ceramic pick ups—made by famous Sonotone! All with these great basic features: Full frequency (response from 50 to 10,000 cycles.) Bell-like supertone makes new or old players thrilling. Climate-proof, moisture-proof, fungus-proof! Lightest pressure saves needle wear, revives worn records. NO needle talk! NO crystals, magnets, filaments to fail. NO pre-amplifiers. Performs perfectly for years!

## 3 NEWEST! TITONE MICROGROOVE PICKUP

For all 45 and 33 1/2 rpm players. Highest compliance and 5 to 6 grams needle pressure give minimum wear on record and needle! Aluminum case—1-mil permanent sapphire needle.

Order #W 7530 ..... \$7.95  
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## 2 NEWER! TITONE 3-MIL PICKUP

New superlight aluminum pickup complements famous original Titone. pickup below. 15 grams needle pressure gives unparalleled reproduction, lowest wear!

Order #W 7540 ..... \$7.95  
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## 1 NEW! ORIGINAL CERAMIC TITONE

Within a few scant months in widest use from coast to coast! Plays at 20 grams needle pressure. Used instead of the newer aluminum Titone above for changers requiring over 15 grams pressure to "flip" records.

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NO TONE LIKE  
TITONE



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SONOTONE, Box 5, Elmsford, N. Y.

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you are certain to know any faults, either inherent or acquired, that it may have."

"I know that a gain measurement is made by comparing the input and output voltages of a signal passing through an amplifier," Barney said; "but how do you measure accurately the input voltage? It seems to me that when you are working on a high-gain amplifier, any input voltage that would give a substantial reading on a v.t.v.m. would be overloading the output stages."

Mac opened a cabinet drawer and took out a little black box with a switch-knob and some pin-jacks on the front and a diagram of the contents, as is shown in Fig. 1, on the back.

"This is a millivoltmeter," he explained. "As you can see here on the diagram, it is nothing more than a tapped resistance voltage divider. Precision resistors are used, and their values are such that when exactly one volt is applied from the audio oscillator, as measured with the v.t.v.m., you can take out one volt, 100 millivolts, 10 millivolts, 1 millivolt, or .1 millivolt. This is assuming, of course, that you are working into a high impedance, as you almost invariably are in the case of an amplifier."

"Do you use the same kind of parts in the amplifiers that you do in receivers?"

"The same kind, yes; but you select more rugged units. Higher voltage condensers, higher wattage resistors, huskier transformers—in fact, you simply keep in mind that the amplifier must stand up under long periods of continuous duty under conditions that are not always of the best, and you keep in mind that the dynamic current and voltage peaks are much higher than are ordinarily encountered in radio service, and then you allow for these factors in your selection of parts."

"But now I have talked myself awake, and we had better get back to work; but just to button up the subject, I might add that the service technician has an advantage over most sound men in that he can service and even actually build much of the equipment he needs. He is in a good position to get business, for people are accustomed to bringing him their electronic problems. If he does not try to bite off too much, he can operate both enterprises so that they do not interfere with each other and yet bring in an income that is substantially greater than he could get from either by itself."

"And he has a fine alibi to give his wife when he comes in early in the morning!" Barney suggested slyly. "He can just say he is a little dizzy from riding the gain."

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## AUDIO NOISE IN INTERCARRIER TV RECEIVERS

By MATTHEW MANDL

AUDIO noise characterized by a buzzing sound in the Intercarrier type of television receivers is more often the result of improperly set controls than it is the fault of a bad part or misalignment. In the Intercarrier system, both the video and sound intermediate frequencies ride through the same amplifier stages preceding the picture detector. At the picture detector, both these i.f. signals mix again by converter action to give a 4.5 mc. frequency. The latter is then channeled to the FM sound detector, while the regular picture i.f. is demodulated and sent, via the video amplifier stages, to the picture tube.

With this type of receiver there is a possibility that the picture signal, which is amplitude modulated, may be superimposed on the 4.5 mc. sound frequency to such an extent that the FM detector will be incapable of removing this sufficiently. This is a result of excessive modulation of the video portion of the carrier, and can be controlled only at the transmitter. When this happens, a pronounced audio buzz is heard from the loudspeaker. Manufacturers, however, reduce this possibility to a minimum by properly balancing video and sound gain through the amplifier stages preceding the detector, and for this reason no trouble should be encountered during normal operation of such a receiver.

If, however, the contrast control is set too high, or the fine tuning adjustment is incorrectly set for best reception of a station, the audio buzz may become noticeable. Many a service call

can be avoided if this fact is brought to the customer's attention at the time the set is purchased.

When proper adjustment of contrast and fine tuning fail to eliminate the audio noise, one or more of the following circuits will have to be serviced:

1. Local oscillator. If the local oscillator is misaligned it will be impossible to properly tune in a station by use of the fine tuning control. Since most receivers have provisions for getting at the oscillator controls by removing the channel-indicating escutcheon and associated knobs, adjustment for each individual station may be made without chassis removal.

2. I.f. stages. Improper i.f. alignment will also increase the audio noise beyond the point where it can be eliminated by the front panel controls. Alignment of TV intermediate frequency stages, however, should not be attempted without the manufacturer's service notes and properly calibrated equipment.

3. FM detector. If the sound detector is not aligned correctly, it may also result in audio buzzing. Component parts should also be checked, for this can, of course, seriously contribute to poor performance. A common fault is a defect in the electrolytic condenser across the output of a ratio detector. This condenser, ranging in value from 4  $\mu$ fd. on up, is essential in suppressing amplitude modulation, and any decrease in value or other defect will immediately be evidenced by an increase in noise output.

-30-

RADIO & TELEVISION NEWS



# NEW TOOLS AND GADGETS

## HIGH SPEED GRINDER

Keller Tool Company, Grand Haven, Michigan, has designed a pneumatic grinder to take all wheels of 1/2 inch diameter and smaller. This Model 30 A-7 tool will grind in close quarters or where intricate designs permit the use of only small grinding wheels as,



for instance, in touching up dies and similar tedious jobs.

This tool, which attains 75,000 r.p.m., has a housing that fits into the hand comfortably, and an inverted throttle lever provides convenient operating control. The standard spindle collet will accommodate mounting grinding wheels with 1/2 inch diameter shanks. Optional equipment includes spindles with 3/16 or 1/4 inch capacity collet chucks.

## PLASTIC STORAGE TRAYS

A metal shelf rack and plastic tray combination has been introduced by the *Andrew Technical Service*, 4747 N. Damen Ave., Chicago 25, Ill., providing an orderly and efficient method for storing the small tools, screws, bolts, electronic parts, etc., used by service technicians.

Complete units of trays and racks or the trays alone may be purchased. A



complete unit consists of a steel shelf section, 34 1/2 by 14 1/2 by 11 1/2 inches in size, equipped with as many as 56 plastic trays. Four removable partitions come with each tray and two of these will make five compartments for the tray.

Two sizes are available in the trays: 11 1/2 by 2 by 2 1/2 inches and 11 1/2 by

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## SPECIAL DYNAMOTOR

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Conversion of 645 for use on Citizen's Band Bringing Excellent Results.

Navy Model ABA-1 (CG-43AAG)  
Army Model SCR-515A known as the BC-645  
450 MC—15 Tubes



BRAND NEW—ORIGINAL CARTON. Can be easily converted for phone or CW 2-way communication. Covering for the following bands: 420-450 MC ham band, 450-460 MC for fixed or mobile, 460-470 MC for citizens, 470-500 MC television experimental. Size 10 1/2 x 13 1/2 x 4 1/2. Contains 15 tubes: 4-7F7, 4-7HT, 2-7E6, 2-6F6, 2-955, 1-WE-316A door knob. Complete as shown above. . . . . only \$17.95

BC-645 ANTENNA. . . . . only 39c



BC-645 TRANSMITTER-RECEIVER ONLY, Brand New, ORIGINAL PACKING. Special. \$12.95

## EVERYTHING GOES!

FL-5 Lazy Q Radio Filter Unit, High Impedance, Brand New. . . . . \$0.75  
Allen-Bradley Relay—24 Volts, DC. . . . . .79  
Reel Control Box, #BC-461-A. . . . . .89  
Microphone Adaptor, M-209. . . . . 1.29

T-24-G MICROPHONE with PL-106 JK 38, Brand New, Original Packing. LOOK! ONLY \$1.95

## A REPEAT SPECIAL! Reconditioned Like New SCR-522

with new components very high frequency transmitter-receiver. 100-150MC, 4 Channels, Crystal-Controlled, Amplitude Modulated Voice. Complete as shown. ONLY \$79.50



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5BP4 . . . . . \$2.45 4AP10 . . . . . \$4.95  
872A . . . . . 1.47 7CP1 . . . . . 2.95  
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Standard Brands All New Tubes

## COIL SETS FOR RADIO SET SCR-183

All Brand New—Terrific Buys!

TYPE  
C-381—Transmitting 2500-3200 KC. . . . . \$1.95  
C-382—Transmitting 3200-4000 KC. . . . . 1.95  
C-384—Transmitting 5000-6200 KC. . . . . 1.95  
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C-376—Receiving 2500-4700 KC. . . . . 3.95  
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MC-125 Tuning Unit, part of radio set SCR-183 . . . . . .79



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## FIELD TELEPHONES

Army surplus, completely reconditioned with new handsets, electrically tested, in excellent used condition. Only \$6.95

BRAND NEW FIELD TELEPHONES . . . . . \$9.25

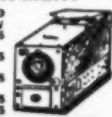


BC-348 RECEIVER—Brand New—Original Packing. . . . . \$165.00  
BC-348—Excellent Condition—Used only 125.00  
PE-94C Dynamotor for SCR-522—Brand New. . . . . 5.95  
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Plug-in Set for 522—Brand New. . . . . 4.95  
PL-35 Plug . . . . . .35  
PL-68 Plug . . . . . .12

## 274-N COMMAND EQUIPMENT

Sensational Buys!

USED	BRAND NEW
BC-442 . . . . . \$1.85	\$2.75
BC-453 . . . . . 12.95	9.95
BC-454 . . . . . 9.95	6.95
BC-455 . . . . . 6.95	3.95
BC-456 . . . . . 1.95	9.95
BC-457 . . . . . 5.95	7.95
BC-458 . . . . . 14.95	24.95

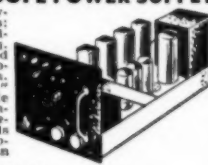


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GENERAL ELECTRIC 30 Mu-f, 90 volts, 3 phase, 60 cycles. . . . . 1.19  
CORNELL DUBILIER 2 MFD 600 V. DC. . . . . .29

## APN-4 RCVR—SCOPE POWER SUPPLY

4 switch-selected screw-driver tuned RF channels; IF freq. 1050 kc, bandwidth 45-60 kc; RF freq. 16 2000 kc. Makes fixed tuner for med. freq. police calls or PA system. Has power supply for 5" scope, with 400 cycle trans. Electronic controlled low v. supply; delivers 260 vdc, 150 milliamps. in .01%. Power supply alone worth more than price.



SPECIAL! ONLY \$8.95 less tubes

## DYNAMOTORS

Type DM-33-A, in. 28 V, out. 540 VDC, 250 milliamps. . . . . \$1.95  
(Excellent—Used) . . . . . 3.25  
Type DM-53-A, 24 V., in. 220 V., 80 MA out. . . . . 1.95  
INVERTER—PE-206, 28 V. in., 80 V. at 500 VA, 800 cy. out. . . . . Brand New 4.95  
(Used, Excellent Condition) . . . . . 3.25

## WAR SURPLUS BC-375-E TRANSMITTER

Here's a sensational buy! Has five tubes, five tuning units. Xmt. designed to operate from 200 kc. to 12 mc. (less BC band). Equipped with antenna tuning unit BC-306-A—variometer and tap switch. Dynamotor (PE-73-C) complete with relay, fuses and filter. Weight: approx. 275 lbs. Excellent Condition. SPECIAL \$44.50



## HEADSETS—Reduced Prices!

HS-23 Headset—Brand New with ear pads. . . . . \$2.95  
HS-33 Headset—Brand New with ear pads, cord and PL54 plug. . . . . 2.95  
Extension Cord (CD-307) with PL53 and PL54. . . . . .59

Mazda 623, 24-28 Volts, Pilot Light, Box of 10 . . . . . Special 69c

SD-72 12 line portable monorecord, magneto-telephone SWITCHBOARD used primarily in field wire systems. BRAND NEW \$22.95 USED, EXCEL- LENT CONDITION \$14.95

Control Box BC-434-A . . . . . \$4.95

Control Box BC-448-A . . . . . \$4.95

CONTROL BOX BC-690-A. Brand New. SPECIAL \$3.95

Multitester Foundation BIAS METER 1-97A

Contains a zero center 3 1/2" round Marion voltmeter calibrated 0-100 volts each side. Movement in one mill each side of center. The unit is mounted in a steel box 7" x 5" x 4 1/2" and contains a contact push button, line cord dual 100 MFD at 200 V DC Aerovox condenser, a potentiometer 6 1/2 RC 1% wire wound non-inductive resistors: one 400 ohm, two 2500 ohm, one 5000 ohm, one 10,000 ohm, one 15,000 ohm. Excellent for building a zero center multitester with ranges of 1, 10, 100, 1000 volt. COMPLETE BRAND NEW \$3.95



# PLATT ELECTRONICS CORP.

DEPT. A, 489 BROOME ST., NEW YORK 13, N. Y.  
PHONES: RE 2-8177 and WO 4-2915



# ROTATED

## All-Channel TV-FM

# ANTENNA

# PRICE-CUT

# 72%

Now you can have all the advantages of a rotated roof top antenna for only \$27.50. The Square Root Manufacturing Corporation with the thoroughly tested Quad-Loop antenna have put rotated antennas within the reach of every TV set buyer.

You no longer need to pay up to \$115.00 to enjoy the very finest in TV reception. The Quad-Loop is rotated electronically. A single control at the receiver rotates the beam a full 360°. Quad-Loop selects maximum gain for each channel regardless of geographic location of the transmitting station. Ghosts and noise pick-up, a serious problem for all previous antennas, are either wholly eliminated or substantially reduced.

The quadrature-phasing control makes the Quad-Loop an extremely easy 1-man installation. No roof top orientation is necessary. Since there is no mechanical rotation, long trouble-free life is assured. Ask your local dealer to show you this remarkable new Quad-Loop; or if he does not have one, write direct to Square Root Manufacturing Corporation including the name and address of your local dealer and enclose check or money order for \$27.50. The antenna will be sent postage prepaid. No antennas will be shipped unless you include the name and address of your local dealer.

**DEALERS — JOBBERS**  
Write today for full details and discounts on the Quad-Loop, Di-Loop and Wind-O-Loop all-channel TV-FM antennas.

FIRST WITH ELECTRONIC ROTATION  
GREATEST PRODUCER OF BUILT-IN  
TV ANTENNAS IN THE WORLD

# SQUARE

# ROOT

Manufacturing Corporation  
903 Nepperhan Ave. Yonkers 3, N.Y.

160

3¼ by 2¼ inches. They are of transparent molded Polystyrene, with an index card slot and finger pull at the front. A card may be placed at the back of the partition also for identification of contents.

### PORTABLE SANDING KIT

Electric drills may now be used for sanding and polishing operations in addition to their regular applications with the aid of a kit offered by *Portable Electric Tools, Inc.*, 320 West 83rd St., Chicago 20, Ill. This consists of an adapter with a ¼ inch shank that will fit any make of electric drill, plus one molded-rubber sanding disc, two gar-



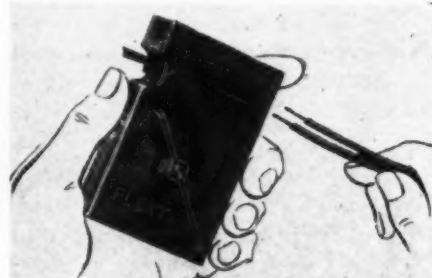
net abrasive discs, and one lambs wool polishing bonnet.

The kits are available in two sizes: the SP 40 comes with a four-inch disc, while the SP 50 is supplied with a five-inch disc. Complete details on the Model 50 sanding kit will be sent by the firm on request.

### WIRE STRIPPER

*Electro-Steel Products, Inc.*, 112-14 N. Seventh St., Philadelphia 6, Pa., has introduced a Flextron 300 ohm lead-in stripper that accomplishes the necessary work in only one operation.

The unique feature of the device is its simplicity; whereas most strippers



require three separate operations, the Flextron necessitates just the insertion of the wire and the job is done.

### AUTOMATIC SOLDERING IRON

Designed to fit any standard electric soldering iron from 75 watts to 250 watts, the "Solder-Matic," distributed by the *Stern Corporation*, 436-A Fourth Ave., Pittsburgh, Pa., will automatically feed solder to the tip of the iron. More than six feet of solder, ¼ to



## WOUNDWOOD\* PLYWOOD MASTS

- Stronger than Comparable Steel Masts
- Lighter than Aluminum
- Revolutionary new development in antenna masts, for Radio Amateur, Television, and other uses.
- STRONG: Free-standing (no guy wires) up to 24-ft. Guyed up to 90-ft. 1 man can easily erect 24-ft. mast! 2 men assemble and erect 90 ft. mast in less than 1 hour!
- NON-CONDUCTIVE: Lead-in runs inside mast.
- Inexpensive—and light weight keeps freight charges down!
- Now used by DuMont, Federal, and other leaders in the field.
- ALSO AVAILABLE: 50 ft. auto masts for use in field measurements.

\* Trade Mark of Southern Industries of Mil., Inc.

DISTRIBUTORS: Some attractive territories still open.

### SPECIAL PURPOSE PRODUCTS CO.

155 Perry Street  
New York 14, N. Y.

## FOR BARGAINS IN

Receivers, Transmitters, Amplifiers, Television Sets, Batteries, Instruction, Surplus Parts, Phonograph Records, and many more items.

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RADIO-TELEVISION

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Be the Radio-Television Expert of Your Locality Who Handles the Toughest Service Jobs. This new, 7 volume set gives you solid working knowledge of Radio and Television. Very latest on Television Servicing. Covers everything from fundamentals to newest in FM, Television, Electronics, etc. Clear, practical. Tells you how to construct, install, service. Short-cut trouble shooting methods. Handy "on the job" Radioman's Handbook included. More than 2500 pages, 1200 illustrations, charts, diagrams.

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Act at once and get with APPLIED RADIO-TELEVISION book of "150 Radio-Television Diagrams Explained" FREE. Keep it even if you send the set back at our expense within 7 days. If you keep the set, send either \$22 cash, or \$3 in 7 days and \$3 a year! Send coupon TODAY! It's not an order—just a request to see the set and get the Diagrams book Free. Act now!

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Rush 7-Volume "Applied Practical Radio-Television," postpaid, for 7 days FREE Trial per your offer.  
Include FREE Book of 150 Radio-Television Diagrams.

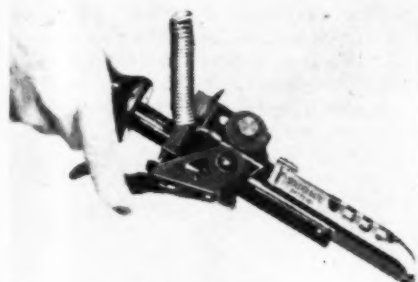
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Town \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

RADIO & TELEVISION NEWS



$\frac{3}{16}$  inches in diameter, can be held in the device, and just a slight pressure on the trigger of the attachment brings the solder right to the tip of the iron in the exact quantity needed for any job.

A Home Craftsman Model, consist-



ing of an Underwriters Approved 85 watt electric soldering iron, the attachment, and six feet of solder, has been made available as a unit, although the "Solder-Matic" device itself should find wider use in factories, electrical shops, and like industries.

#### HANDY SCREW HOLDER

Designed to handle very small screws and screws that must be placed in hard-to-reach spots, a new screw holder made by the *Handy Industries*, Dept. 232, 141 Jackson Blvd., Chicago 4, Ill., has recently been introduced.

The holders come in a set of three sizes, consisting of a 10, 7 and  $4\frac{1}{2}$  inch holder, and in widths of  $\frac{3}{16}$  and  $\frac{1}{8}$  inch.

Although the hardened tips of the tools are not intended to serve as a screwdriver, they are quite strong enough to get it started and well on the way.

#### CONDENSER CABINET

As a no-cost feature of its new condenser kit, *Cornell-Dubilier Electric Corp.*, South Plainsfield, New Jersey, is offering a three-drawer metal cabinet, 5 by 8 by 20 inches in size, complete with an assortment of twenty condensers.

The lift top and two sliding drawers of the cabinet, which is in olive drab



baked porcelainized finish, permit the whole to be hung on a wall within easy reach. The drawers have compartments for additional stock, as well as for the condensers originally provided.

#### ALIGNMENT TOOLS

The *Walter L. Schott Co.*, 9306 Santa Monica Blvd., Beverly Hills, California, has introduced a new line of TV-FM alignment tools for radio and television service technicians, including all

## SURPLUS PRICES SLASHED!



#### DYNA-MOTOR D-2

D-2 Converts to 110 V AC in ten minutes, diagram included, contains integral gear box having four 1/2 drive shafts turning simultaneously at the following speeds:  
4000 RPM—Grinders, buffers, flexible shaft tools, etc.  
1500 RPM—Wrapping fishing rods, slow speed tools.  
25 RPM—Dev. tray rocker for photo darkroom.  
5 RPM—Turning barbecue spits. Adv. Disp. Beams. A Thousand Other Uses Around the Work Shop. ONLY  
CONVERTED TO 110 VOLTS AC.....\$7.45

#### DYNAMOTOR D-1

D-1 Converts to 110V AC in ten minutes, diagram included, has shaft with squirrel cage blower, also gear reducer with 2 shafts and pulleys at the other end. 1001 uses.....Only \$4.95

#### ANTENNA RELAY UNIT

BC-442 010 RF Amp. Meter, change-over unit for use with Command Set Transmitter. Brand New. Each \$1.95

#### PLUGS and CONNECTORS

YOUR CHOICE for only each 49c

For the SCR-522.....PLQ-167, PL-172  
For the BC-348.....PLQ-103  
For the BC-733.....PLQ-254  
For 260-F Radio Compass Inverter, PL-3108-22-48  
For the SCR-274-N.....PL-147, 148, 151, 152, 153, 154A, 156, 258  
For the BC-375.....PL-59-PL-61-PL-64  
For the AHT-15.....U-8U, U-10U, U-16U  
For the ABC-1.....U-13U, U-16U  
MC-203A coupling Coax Fittings—  
PL-259A (83-18P) UG-21U-UG-22U  
PL-164 M-359 U-11 U  
PL-63 SO-44 PL-62  
PL-56 SO-88  
AN-3108-28-18P AN-3108-12S AN-3100-12S-33

#### BC-733 D

A 10-tube superhet receiver for lateral blind landing guidance (CAA type certificate) TC-1045. Excellent condition 100-110 MC. Tube complement: 1-12SK7, 2-12SR7, 1-12A6, 1-12AH7GT, 2-12SG7, 3-71A —tubes alone worth more than this low price. \$3.95  
SCHEMATIC FURNISHED.....Each

#### COMMAND SETS

BC-454—Receiver 3-6 MC. Used. Good condition.....\$5.95  
BC-457 TRANSMITTER  
4-5.3 MC. Can be converted to 80 meters with slight modification.....\$8.95  
BC-458 TRANSMITTER \$7.95  
5-7 MC.

#### AN/CRW—2 V.H.F. RECEIVER

6 tubes: 3-6SL7, 1-6SN7, 1-6SG7, 1-6J5, Dynamotor, plug-in coils and sensitive relays. This was one of the Army's "Secret" V.H.F. remote control receivers. Operating at about 110 MC. A thousand and one uses. Like new in a metal case. Each \$4.95

#### COMPLETE BEAM ROTATOR ASSEMBLY LP-21A AND I-82A

A large 5" indicator I-82A, and an LP-21 loop (removed from aircraft). A complete perfect beam rotator system with indicator. Loop is low impedance—contains seleny transmitter, etc. \$7.95  
Loop alone.....\$5.95 Indicator alone.....\$4.25

#### TU 10B

Tuning unit for BC-375.....a terrific parts value with a metal case. Brand New. See page 24 Nov. '48 Radio Craft for conversion to 10 meter final. \$2.95  
Without case \$2.10

#### 6 VOLT MOTOR

A real beauty, removed from aircraft. Type used for auto fan. Each \$1.29

#### BC-433G

15-tube superhet radio compass receiver 200 to 1750 Kc: CW-tone-voice. Like new. Similar to R5/ARN7. Schematics furnished. Only \$19.95

#### TUBES

1025.....3 for \$1.10 6X4 Scope tubes @ \$1.95  
6V6.....@ .35 5BP4 Scope tubes @ 2.50  
3D6.....@ .35 35Z5.....@ .40

#### 6" PM SPEAKER

Beautiful new stock. Alnico magnet. Each \$1.95

#### FREQUENCY METER TS-69/AP

Frequency range 341 mc. to 1,000 mc. Ideal for labs, schools, or for hams experimenting with eqpt. for civilian phone band. Black crackle finish metal base, dim. 6"x6"x2", contains variable length coax resonating cavity with crystal rectifiers and O-200 microammeter. Yee-er. Root counter and calibration charts insure extreme precision. Telescopic antennae, and coax line probe, with equipment. Complete, Ex. \$29.95

#### RM-29 PORTABLE FIELD TELEPHONE

An ideal portable field telephone. Complete in a rugged steel case for years of wear. Ringer circuit and TS-13 handset. No leather case to deteriorate. Compact 5"x6"x9"—also used as remote control on SCR-284. Simple two wire operation. 15 miles distance and upwards. Can be used for television installation, intercom system, construction companies outside and inside work, etc. Light weight. 13 lbs. Excellent condition. SPECIAL LOW PRICE EACH.....\$9.95 2 for \$18.95



#### CONTROL BOX

##### BC-450

Used for remote tuning and operation of command receivers. Has three independent units in one, each consisting of dial crank, volume control, C. W. phone switch, female power connector and phone jack. Used. Excellent condition.....Ea. \$1.75

#### INTERPHONE CONTROL BOX

##### BC-606

Contains volume control, mike and phone jack, switch, metal case, valuable parts. 39c  
New.....

#### BATTERY TESTER

A 2" meter 0-6 V.D.C. 3 for \$1.00

#### SCR-610

10 meter crystal controlled F.M. transceiver for mobile use. Uses local low drain tubes with an attached power supply designed to operate on 6, 12 or 24 volts B.C. Less tubes, but with two crystals. Used, excellent condition with power supply. ONLY \$43.95

#### MIKE ADAPTER

M-290 for SCR-522 permits use of carbon mike in place of magnetic.....New. Each \$1.50

#### WAFER SWITCHES

10 assorted, rotary, gang. Removed from equipment.....ALL 10 for \$1.00

#### CORD CD-605 AND CD-604

A two-foot cord with a PL-55 plug; with low to high impedance transformer for your headset. 39c

#### CORD CD-307

A six foot head set extension cord with PL-55 plug on one end and a jack on the other. NEW.....Six foot \$59c

#### ANTENNA LOADING UNIT

MC 432 contains 2 pole, 5 position rotary switch with silver ceramic variable condensers, and coils for matching V.H.F. transmitter to AN-109 antenna with 50 ohm line. Useful parts.....New. Each \$1.25

#### MALLORY SWITCH

6 pole, 3 position. NEW.....25c

#### TOGGLE SWITCH

S.P.D.T. luminous tip bat handle. NEW. 4 for \$1.00

#### BC-1206

Beacon Receiver 200 to 400 K.C.'s 28V plate and filament. Easily converted to broadcast band by adjusting of slug and tuned coils. Each \$5.95

#### T-17 D MIKE

The desirable single button carbon mike. With press the button to talk switch. 4' cord and PL-68 plug, mike cover. Features non-echo effect. New \$2.49

#### PE-218

Input 25-28 VDC—62 amp. output 115V. 350-500 cycles, 1500 Volt amp. Used. Good condition.....\$5.95

#### FILAMENT TRANSFORMERS

Fully shielded Pri. 100 V. Sec. (21 winding 10.2 V @ 5 A. C. T.: 22 winding 10.2 V @ 10 A. C. T.) Secondary winding can be connected in series to supply 25V. with a line Voltage of 115 Volts—60 Cys. ....New Each \$2.49

#### PE-206

Input 28 VDC—38 amps. Output 80V. 800 cycles. Used.....\$5.95

#### DM-53A DYNAMOTOR

24V. in., 220V—80 M.A. out. USED. Good condition.....\$1.39

MINIMUM ORDER \$2.00. ALL PRICES F.O.B. CHICAGO. 20% Deposit required on all C.O.D. orders.

WRITE FOR FREE CATALOG

#### NESCORP ELECTRONICS

2635 W. Grand Ave., Dept. R Chicago 12, Illinois



## Back To Give-Away Prices On C-R Tubes!

### All Brand New in Original Packing

58P1 Same but white screen. Use for remote.	\$1.19
58P1 TV viewer.	\$1.89
58P1 High intensity test scope, extra acceleration anode.	\$1.89

## COMMAND UNIT SPECIALS

### Transmitters

274N Type: 2.1-3mc (Marine) Repacks, like new.	\$12.95
T-18/ARC-5: 2.1-3mc (Marine) Repacks, like new.	\$14.95
T-19/ARC-5: 3-4mc (80 mtrs) Repacks, like new.	\$14.95
BC-457: 4-5.3mc. Like new.	\$4.95
BC-458: 5.3-7mc. Excellent used.	\$5.95
As is Condition.	\$5.95
BC-459: 7-9.1mc (40 mtrs) Repacks, like new.	\$9.95
Fair used, less xtal.	\$5.95
As is Condition.	\$5.95
T-22/ARC-5: 7-9.1mc (40 mtrs) Repacks, like new.	\$9.95

### ACCESSORIES

BC-442: Antenna Relay Unit, with 50 mmfd. 5 KV Vacuum condenser and RF meter.	\$2.95
FT-229: Shock mount for above, used.	39c
BC-456: Modulator, used.	\$1.95
FT-220: 3 receiver rack, used.	\$1.50
FT-221: Shock mount for above, used.	69c
FT-228: 2 Transmitter rack, new.	\$2.15
ARC-5 or FT-226, 2 mtr rack, used.	\$1.50
FT-227: Shock mount for above, used.	69c
DM-22: Dynamotor, BRAND NEW.	\$1.95
BC-218: Flexible drive shaft, for receivers.	\$2.45

### THE HOTTEST 10 METER SPECIALS!

BC-923 REAR: 10 chn. auto. or manual tuning. 27-35.9 Mc. AM or FM. Self cont. spir. Double super-ct. Contains xtal. cal. net-type freq. meter, check points every 100 and 1000 Kcs. Instructions for rewinding 3 of 4 chns., for full coverage 27-150MC and AC power. Exlnt used, checked and guar. OK before shipping. WITH 12V DYNAMOTOR \$7.50

LESS DYNAMOTOR \$24.50

BC-924 XMTN. Mates with BC-923, 30w. 4 chn. with Schematic. Exlnt used.

WITH DYNAMOTOR \$22.95

LESS DYNAMOTOR \$19.95

RA-34 Rectifier for BC-375-E, BC-191: Input 115 or 230 v. 60 cy. Filtered outputs 1000 v. 350 MA and 12 v. 3.2 A. plus 12 v. 14.5A AC. Guaranteed.

FIXED OUTPUTS, NO. 1000 V. \$65.00

VARIABLE OUTPUTS, WITH METERS \$85.00

TUNING UNITS FOR BC-375. Exlnt used. \$1.95

RG-7/U 95 ohm cable. New. \$1.50

### MOBILE POWER SUPPLY UNIT

PE-237 Heavy Duty vibrator type to meet every mobile power need. Input 6, 12 or 24 VDC at flip of switch. Outputs: 525v 95 ma (some nameplates read 16 ma, same components; so the "95 ma" is grossly under-rated); 105v 42 ma; 6 v. 2 amp; 4v 2400 ma; 1.3v 450 ma. Complete with tubes, spare tubes, vibrators, and spare vibrators. Case shock mtd. and waterproof. BRAND NEW \$14.95

Same, not packed but appear to be new, screwed to wooden boards used in export packing. \$10.95

### TRANSMITTER BUY OF THE MONTH!

BC-375-E. Operates 200 kc to 12 mc (low DC band). Easily converted. Ideal main or stand-by rig. Complete with 6 tuning units, BC-306 Antenna loading unit, PE-73 Dynamotor and filter, complete set of plugs, all tubes, wiring diagram, conversion data. EXCELLENT USED. F.O.B. Arizona. \$19.95

TRANSMITTER ONLY. \$12.95

### CLOSE-OUT BARGAINS! FIRST COME, FIRST SERVED!

NEW ART-13: Xmt. v. DY-12, spare dynamotor, brand new, control box, plugs. \$250.00

LINK TYPE 149B: 50w. FM xmt-r. 70-100 mc. xtal control, 115 v. 60 cy power supply, like new. \$275.00

Same as Above: Less receiver. \$175.00

RAK-4: 15-600 KC Recr w/115v. 60 cy power supply. \$40.00

RAL-4: 3-23 MC Recr w/115v. 60 cy pwr supply, less output meter. \$30.00

DE-15: 15-1500 KC Recr. Excellent condition. \$35.00

DE-2: 15-1750 KC Recr. excellent condition. \$40.00

BC-639: 100-156 MC Recr. RA-42 15v. 60 cy power unit and connecting cord, like new. \$225.00

Same as Above: Less power supply and cord. \$200.00

BC-638: Freq. Meter 100-156 mc w/built in 115v. 60 cy pwr supply. \$175.00

ASB-7: Indicator, oscilloscope. Builder's delight. Only \$10.95

### CITIZEN'S BAND IS LEGAL!

BC-645 Xmt-Recr. 15 tube intercom-receiver designed for airborne use. 460 to 490MC. With modification (instructions furnished) set can be used for 2 way communication, voice or code, on following bands: 420-450mc Ham; 450-460 mc. Aired and mobile; 460-470 mc. Citizens; 470-500 mc. TV experimental. Complete with all tubes, etc. Edoorknob tube. Size 103x131x43 1/4. Wt. 25 lbs. BRAND NEW \$14.50

PE-101-C Dynamotor for above, 12 or 24 v. \$2.65

Extra Doorknob tubes, each. 39c

### DIRECTION FINDER SPECIAL!

DU-1 LOOP. 12 or 24 v., easily changed to 6 v. 2 stage pre-amp., put ahead of any recr. to make manual DF. Obtains power from recr. Tunes 195-1000 kc., easily extended thru 2800 kc. Correct bearing immediately, no 180° ambiguity. With schematic, operating and freq. extension instructions. BRAND NEW \$27.50

BC-223-AX TRANSMITTER. 15 watts, brand new. With used 12 v. dynamotor PE-53, connecting cable, 4 marine freq. xtals. and mike. \$89.50

### SPEAKER SPECIALS!

6" Hvy Duty PM. General Electric. \$1.89

Outdoor Waterproof. Navy Bulkhead spkr. phenolic cone, very heavy PM for Hi-Fi and efficiency. With univ. matching xformer in gasketed case. Handles 25 w. Excellent used. \$9.95

### LOOK WHAT \$2.65 WILL BUY!

6 V. DYNAMOTOR. Very low battery drain. Multiple windings! 250v. DC @ 100ma to 250v. DC @ 50 ma. Second winding gives 190v DC @ 70 ma. No brushes to add or shift around! No mechanical work! Complete close sheet furnished, connections, etc. BRAND SPARKING NEW! ONLY \$2.65

WHIP ANTENNA. Make 16' tapered whip for 10 and 20 meters or any other length. Mast sections each 3/8" MS-53's screw together, then taper off with MS-52, 51, 50 and 49. No base. Buy extra MS-53, saw off for female receptacle to improvise base. Per section. 39c

SPECIAL! MS-51, 10 for \$1.39

METALLIC MINE DETECTOR SCR-625 with RA-38 battery. For non-ferrous or ferrous metals. Also operates under water. Brand new, export packed. \$39.50

WILLARD 2V. BATTERIES. Dry charged. Transparent plastic case, 3 balls. New, orig. cartons. SPECIAL \$9c

Wanted! Your Spare Surplus Equipment and Tubes! Dynamotors, recrs, xmts, test equipment. Send list, stating condition and your rock bottom price.

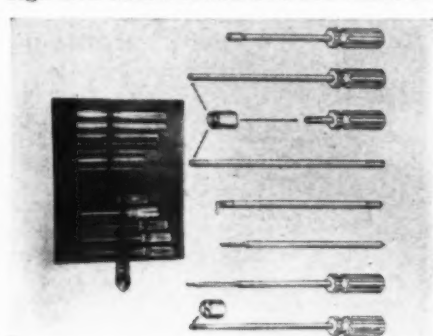
Remit with order. Calif. buyers add sales tax

**G. L. ELECTRONICS**

1260 S. Alvarado St., Los Angeles 6, Cal.

of those needed for present-day sets and most of the 1950 models.

These tools are entirely new in design and construction and are made of



a new plastic that is unbreakable and yet very flexible. The inserts are made of tempered steel, chemically welded to the shafts, while the handles are made of plastic to facilitate precision alignment.

Although the tools are available in pocket-size leatherette kits or on a Masonite wall rack for the shop, they may also be purchased individually and separately.

### TWO-WAY VISE

Besnel Products, Inc., 3525 Auburn St., Rockford, Ill., has designed a two-

way device that may be either bench mounted or held while operating by means of the cast aluminum handle. When bench mounted, it measures 3 inches in height, and with the handle attached it is 6 1/2 inches long.

The vise is of 40-E cast aluminum, and although light in weight, it is strong and durable. One jaw face is double-V notched to hold pins securely for filing, grinding, sawing, etc., and both jaws open to 3/4 inch.

It is an ideal tool for general home



use and is also an item that should be popular with hobbyists, radio and television technicians, pattern makers, tool and die makers, jewelers, and others who work with small pieces of metal, wood, and plastic.

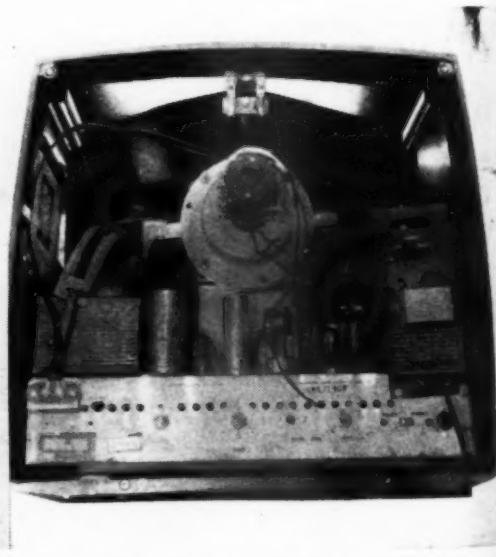
## PHILCO BUILT-IN TV ANTENNA

A BUILT-IN electronic aerial system that provides good reception when used in reasonably strong signal areas has been designed by Philco. The antenna system, illustrated in the accompanying photographs, has four main elements, as follows:

The antenna itself is made of two sections of aluminum foil which are attached to the under side of the top rear of the TV cabinet and which will receive signals from all of the present twelve channels with frequencies from 54 to 88 mc. and 174 to 216 mc.

A variable condenser controlled by a tuning knob is also connected by means of a plastic rod extending the depth of the cabinet. The knob projects through a slot at the top front, making it possible to directly tune the antenna for the best picture.

Philco electronic built-in aerial shown mounted in a table TV receiver (Model 1104). Note the aluminum foil sections attached across the width of the under side of the top of the cabinet. In the top center is the tuning condenser assembly and behind that the "hairpin" coil and 300 ohm line. The two shorter loops are shown end-on, at either side of condenser assembly.





## Spot Radio News

(Continued from page 18)

ions being tossed around the hearing hall lobbies. Representatives of many manufacturers felt that there were too many roadblocks ahead to permit any immediate application of color. Some said that at least three years might pass before all the field work on the equipment and standards could be completed. All agreed that the elimination of fear of receiver obsolescence, through the application of current-type sets in all of the proposed systems, was cheering news and might act as a very effective stimulant to color progress.

Sharpest criticism of the color proposals came from Dr. Allen B. Du Mont who said that . . . "final determination of commercial color TV requires extensive experimentation and field tests. Such tests are imperative before the FCC can consider adopting standards. This will take years. . . . We hope the discussions on color will not cloud the major issue before the FCC, which is the practical assignment of very-high and ultra-high channels to make full use of the spectrum, to prevent monopoly, and to provide the widest service to the public as quickly as possible."

Dr. Thomas T. Goldsmith, Jr., director of research for *Du Mont* and one of the nation's outstanding authorities on propagation, supported Dr. Du Mont's comments and offered an allocation solution in the form of a plan wherein the present twelve channels would be used to the fullest extent, with four channels per city being allotted to most of the 140 metropolitan districts and 48 ultra-high channels, each six megacycles wide, assigned to assure adequate service in other communities. The program would also provide for the reservation of twelve additional ultra-high channels, each six megacycles wide, to protect smaller communities not yet ready to embrace TV and insure that adequate frequencies would be available when they are ready; setting aside of nine other ultra-high channels for non-commercial education purposes; allocation of present band and higher band frequencies in such a manner as to assure competitive operation and a wide choice of programs; and minimization of intermixture of standard and higher channel assignments to reduce or eliminate the need for set owners to buy converters or for station owners to utilize transmitters for two supplementary frequencies.

The color hearings, already in full swing, were scheduled to be followed by extensive testimony on a variety of black and white problems by *Paramount Television Productions*, *20th Century-Fox*, *Raymond M. Wilmette* of Washington (who planned to discuss his polycasting method and also the use of FM for video), *Mayor David L. Lawrence* of Pittsburgh, *Television Research* of Washington, *Daily News*

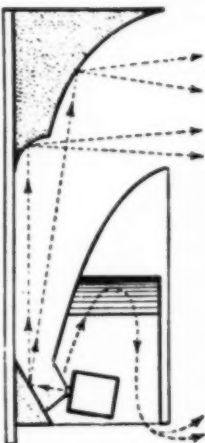
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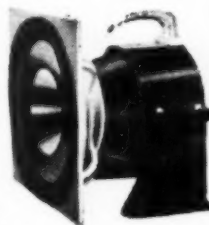
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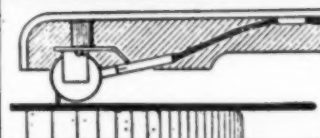
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Television Company of Philadelphia, United Detroit Theatres, Philadelphia Chamber of Commerce, and dozens of others.

Original plans for an announcement of an acceptable allocation plan before the first of the year were shattered by the bombardment of briefs and requests for appearance at the hearings. It appears now as though spring will probably be the earliest date when a suitable plan will be produced.

**POLICE RADIO** received quite a tribute from the Mayor of New York City, William O'Dwyer, at the recent New York conference of the Associated Police Communications Officers.

Citing his days as an . . . "old-time copper, as one who understands the work of police," the Mayor declared that he knew the value of improved police communications within the communities and between the various communities.

He declared that . . . "We have gone a long distance in the thirty-two years since Commissioners O'Brien, Whalen, and myself were rookie policemen in this city. At that time, if you were in trouble you had the opportunity to rap your nightstick three times on the sidewalk, in the hope that your side partner, a mile away, might hear it. And that was communications when we were cops. . . . Or you blew your whistle. Or you made some outcry. And if a crime was being committed within your sight, and you were single-handedly unable to cope with it, you gave an alarm to the perpetrators by that very outcry. . . . In this modern world the business of taking advantage of the improvement in communications not only within the community and within the precinct, but within the neighborhood, within the city, within the state, and within the nation, becomes of the utmost importance, both in the preservation of life and the protection of property, which are the basic purposes of any police department. . . . We are, today, throughout the nation, principally due to improved communications, actually neighbors. . . . We know that our police in every part of the country are engaged in warfare against the organized criminal, and if we are not prepared to take advantage of every single gift that comes from the laboratories, the chemists and the engineers, and the inventors in the line of communications, our efficiency has been lessened by that degree."

Commenting on international policing and radio, the Mayor told of his trip to Mexico City where he found the police department equipped with two-way walkie-talkies and able to contact border patrols quite effectively.

"I was delighted to see that," he said, "because from now on, with these improved communications, we must prepare to reach out beyond the boundaries of our nation. The day is quickly coming when we will have to

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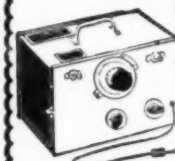
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RADIO & TELEVISION NEWS



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**THE WORLD'S MOST** productive laboratory, the Bureau of Standards in Washington, has now become the site of a unique tube ruggedization program under the direction of I. L. Cherrick of the Bureau's Electron Tube Laboratory. The Bureau's facilities for testing the ruggedness of tubes now include vibration apparatus, mechanical resonance testers, high-impact shock machines, and high-speed centrifuges. Some tests are conducted with typical electrical voltages applied to the tube elements so that noise modulation, short circuits, and other effects can easily be studied. Destructive field conditions can be reproduced through the proper choice of vibration, resonance, impact, and acceleration tests.

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## IMPORTANCE OF PROPER ION TRAP MAGNET INSTALLATION

By R. H. van HAAGEN

**R**ECENTLY there have been more and more TV sets brought in for checking having all of the symptoms of weakening tubes, but with all tubes checking in the normal to better-than-normal range. This is especially true of the RCA 8T241 and similar Fada, Emerson, and other make receivers.

The trouble has subsequently been found to be in the positioning of the ion trap magnet, which in the newer sets is a horseshoe-shaped spring clip with the magnet at the closed end. The clips are supposed to be placed over the "flags" inside the neck of the picture tube and to be positioned for maximum brightness.

In most installations the heavy magnet is placed at the top of the tube, since it is more easily slipped on from the top. However, the weight of the magnet soon pulls the assembly out of position when the set receives normal household vibration. The trouble can be confused easily with the gradual decrease in the gain of amplifier tubes.

The cure: Simply reinstall the assembly from the under-side of the tube neck, reversing the poles so as to preserve the correct north-south relationship, and adjust the trap for maximum brightness.

-50-

November, 1949

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## LETTERS

from our readers

**YOUNGSTER WITH A MESSAGE**  
**E**T IS a very good idea, I think, to  
train more hams of high-school  
age. I am fourteen years old and first  
became interested in ham radio at the  
age of twelve. Several times I have  
tried to get other boys my age to work  
for a license, but they backed out be-  
cause they thought it was too difficult.

"For those who are discouraged by  
the seemingly 'difficult' exam, I will  
say that anyone above the age of  
eleven years, possessing average in-  
telligence, can take and pass the FCC  
tests, if he or she is willing to work.

"To abolish the code test would be to  
take away at least one of amateur  
radio's practical values, that of having  
many self-trained code communica-  
tors. Another thing: think what would  
happen in case of an emergency where  
a transmitter has only c.w. to send a  
QRRR with, and none of the hams in  
the vicinity knows code. I don't be-  
lieve in code as an obstacle to keep  
the ranks of hams thin; I think that  
there should be a beginner's class li-  
cense requiring only about 8 or 10  
w.p.m., using a portion of one band,  
perhaps.

"FB on your program to get more  
'new blood' into amateur radio."

James Douglas, W2BMF  
51 N. 53rd St.  
New York 19, N. Y.

### AIRCRAFT RADIO

**I**N MY avid perusal of your most  
excellent magazine, I have no-  
ticed in the last few editions a rabid  
controversy raging over the code test.  
I believe code is a good thing. If a  
person is too lazy or indifferent to  
master a small item like the Morse  
Code, he could hardly be expected to  
do the other things that separate the  
good amateur from the person who is  
vaguely interested in radio.

"The writer who quotes the example  
of aircraft control, stating that code  
is outmoded, reveals himself unfa-  
miliar with that system. True, aircraft  
flying over land where ground stations  
are only a few miles apart do use R/T  
exclusively, but in aircraft there is no  
radio equipment that will give depend-  
able R/T communications under ad-  
verse conditions over a range of a  
thousand miles or more. Most long-  
range aircraft control is by c.w.

"One of my pet peeves is the person  
with more money than brains or con-  
sideration for others who uses far  
more power than necessary for com-  
munication. Methods such as these  
are not encouraging to the beginning  
ham.

"Enough beefing. I find the series,  
'The Beginning Amateur,' very good.

For one thing, they do not use that  
phrase 'the circuit is conventional.'  
Perhaps it is to some people, but to  
new hams it is still a deep subject.

"Once again, my compliments to  
your excellent magazine. Keep up the  
good work."

Lloyd O. Olsen  
1928 Central Ave.  
Prince Albert, Sask., Canada  
\* \* \*

### FOR DEVELOPING U.H.F.

**F**OR about 2½ years, I have been  
a reader of your publication and  
believe it is the best in its field, from  
my standpoint; I am not a ham but  
hope to be some day, and the informa-  
tion you publish is not too technical  
for the ordinary reader.

"Lately, I have noticed the pros and  
cons on the code test in the 'Readers'  
department, relating to the amateur  
license. This test should never be dis-  
continued on the 160, 80, 40, 20, and 10  
meter bands. The elimination of code  
tests would only open the way for a  
great many newcomers who would  
memorize the theory and regulations  
of the exams and appear on the air  
with high-power, 'store-bought' rigs,  
contributing nothing to the amateur  
game.

"If these people who want to be  
amateurs and cannot see the use of  
code are really sincere, let them have  
licenses to operate in the u.h.f. bands  
and let them develop that, the same  
as the hams had to develop the bands  
they are now using."

Robert E. Black  
Riverhead, N. Y.  
\* \* \*

### CITIZENS' BAND FOR PHONE?

**A**FTER reading 'Letters from  
Readers' in your August issue,  
I would like to point out a few reasons  
why c.w. is and should continue to be  
part of the training which every pros-  
pective amateur must undergo.

"Most prospective amateurs and a  
few of the licensed ones are quick to  
state that code is outmoded because  
many types of communication, both in  
industry and government, use voice in  
preference to code. Let's look at the  
problem clearly. If one has a clear  
channel, if the desired range is rela-  
tively short, and if the service required  
is more of the 'conversation' type, then  
voice is certainly justified as a means  
of communication in that particular  
service. Taxi and plane-to-ground ser-  
vice, for instance, is mainly composed  
of short questions and answers, re-  
quiring little effort on the part of the  
operators because the conditions in-  
volved favor that type of service.

"However, just what is the prime  
justification for the amateur's exist-



ence? Certainly if the FCC thought amateur communication was composed of friendly greetings between two or more individuals, the Commission would not feel justified in giving us the number of favorable frequencies we presently occupy. No. The amateur, first and always, is allowed the privileges he enjoys because he is at the service of his country in peace or war. Granted, then, that the amateur must be prepared to communicate during emergencies when conditions are at their worst. Any operator, amateur or commercial, will tell you that c.w. is the only sure means of rapid communication under these conditions.

"If one wants to just talk on the radio, let him use the Citizens' Band, but if one wants to be a true amateur, worthy of the name 'ham,' let him learn code."

James M. Coleman, W5KTE  
6900 Louisville St.  
New Orleans, La.

#### MORE UNFRIENDLY HAMS

THE letters in your August issue 'Letters' department were certainly good. In one way I agree with those who say code is old-fashioned, and in another way, I can see that knowing it is worthwhile. For instance, if the phone broke down, a ham who did not know the code would be forced to stay off the air until the system is back in order. So, if only for his own sake, knowing code would be a good thing.

"One ham wrote about offering his services to a fellow in the hospital. How about the ones out of the hospitals who would like to become hams? That seems to be a horse of another color. A radio amateur is helpful? That is plain bunk. Darn few of them are willing to try and help a fellow who is interested.

"I made the acquaintance of Nels R. Nelson, W0MEP, of Iowa, on another fellow's station, and since then, he and I have written back and forth, and he has encouraged me to keep on plugging. There is another ham here, too, who has been giving me code practice, and one who has offered me the use of his station until I can build one of my own, but the majority of those I have met at local club meetings offer little help.

"Right now I am stuck between 6 and 8 w.p.m. on receiving; I am not so sharp as I was 15 years ago, since I have been ill, but my ham friends don't see that. Maybe I should take up stamp collecting, like they say."

Joseph A. DuBois  
179 Weld St.  
New Bedford, Mass.

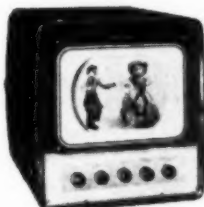
#### 10 W. P. M. AGAIN

IT IS with great interest that I read RADIO & TELEVISION NEWS from cover to cover every month. Reading of the opinions of various readers concerning the new proposed FCC regulations, I thought it was time to add my two-bits worth.

"Recently I graduated from a high

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LEO I. MEYERSON  
W0GFO

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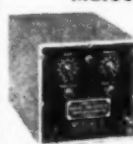
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## 

C.Q. February, 1946, gives 6-page write up w/prints and parts for 2-5-10 meters

115 VAC 60 cycle 15 tube 2 RF & 4 IF stages on one chassis 25"x11"x8" in a metal case with the following tubes and main parts PWR. trans. Thor. 70R62 chokes 4 Thor. 13C30 filter cond. 4 Aerovox 8-8 oil filled. RF & IF coils and tubes shielded. 2 plate tuning cond. has following tubes 1-955 B osc. 1-954 B osc. amp. 1-954 mixer 2-954 1st RF 1-954 2nd RF 4-6SK7 one for each stage of IF 1-6SK7 2nd Det. 1-6SK7 V. Amp. 1-6N7 SW Osc. 1-6N7 SW amp. 1-5W4 rect. this is a super Het circuit each unit cost the Govt. \$292.95 orig. tunes 202 to 208 megs we have converted one to 2 meters & plenty hot, orig. print with ea. unit we furnish you with a print of our changes for 2 meters, all minor changes. Condensers are mica or silver mica Tubes except the acorns are metal.  
The 115 VAC pwr. unit has four section filter capacitors and chokes in place of the usual one this can not be beat. These are a new lot just received, a large quantity available in both the 406 and 406A, the only difference in the 406 and the 406A is there is a 115 VAC motor .65 RPM forward and reversible used for variable freq. control, this motor can be used for a geared beam plenty of torque also units are later model with the same circuit and all like new. Send your order in early; send check or money order for the receiver but do not send the shipping charges; we will ship the units F.O.B. by freight, this is the greatest \$ value on the surplus market; don't miss one at these prices.

MFG. W.E. COST GOVT. \$292. BC406 \$12.95, BC406A \$15.95.

ART-13, a few available w/all tubes, a buy \$165.

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115 VAC 60 cycle Mod. remove the RF section and you have a 2 stage speech amplifier with the following main parts & tubes PWR. trans. Thor. 70R61 Thor. choke 43C02 Amertran audio universal output trans. Sileor 2J871 Pri 20,000 16,000 5000 4000 Sec. 500 15 7.5 3.25 1.25 ohms 30 DB flat 17,000 cy. 955 RF osc. 6J7 Audio Osc. 6J7 Audio Amp. 6F6 2nd Audio Amp. 5W4 Rect. National Vernier Dial in a shielded metal case 15"x9"x8" print w/ ea. unit being sold for less than the cost of the Audio trans. Govt. cost \$115. MFG. W.E. a give away at. \$5.95

## 

Test Set 1-236 for AC DC Res. Cap. W. Inst. book and prods in metal case. Spec. new. \$2.95  
Xtals 500 KC lab. studs. 2 pin mount. \$1.50

McCONNELL'S 3834 Germantown Ave., Phila., Penna. RA5-6033

school that received a deluge of war surplus equipment after the war. We all had hopes of being able to set up a ham station in the school and would have except for one reason: code. Why in the name of Jehosaphat should American hams be required to pass a 13 w.p.m. test when the rest of the world requires only 10 w.p.m.? It's not that 13 w.p.m. is so much faster than 10 w.p.m., it's the principle of the thing.

"True, our fathers started on c.w., they had to. They also listened with headphones, drove a Model-T, and danced the Charleston. The old story about a ham not being qualified to operate a ham station if his code isn't up to speed is a lot of hooey. I received my First-class Commercial Radio-Telephone license last summer and don't know much about code. Yet I am qualified as far as theory goes to operate a commercial station.

"If the FCC would open up everything from 6 meters on up into the microwaves, so that we who are interested only in the technical side of radio, and who are qualified, could operate—well, these are just a few things I've been thinking about."

Darrell Forsberg  
12023 Dayton Ave.  
Seattle 33, Wash.

## 

"TO help further the cause of ham radio, I would like to offer my services as a code instructor in the New York area, preferring to have the class or classes comprised of at least six or more; they would have to be held at night.

"I am a member of the U. S. Naval Reserve, call letters N9RAH, formerly located in Le Roy, Michigan, and will be pleased to hear from interested persons direct, or through RADIO & TELEVISION NEWS."

C. A. Cool, W8WYP  
Gross Sales & Service  
214 W. 14th St.  
New York, N. Y.

## 

"SERVICING Simplified" by Cataldo and Richard in the January issue and the one in the April issue were probably not meant for top-flight servicemen like Mr. Burke, but for the beginner. I, being a beginner, look in several magazines in the hope of running across such articles and when in twelve issues I get two or three, I consider that I have my money's worth. Incidentally, the 'Cathode Follower V.T.V.M.' in the August issue and the 'Experimenter's Power Supply' published in September I thought were very good. I would like to see more of the same.

"Mr. Burke should seek his own level. There are probably articles that will test his mettle, and if he is helped somewhat he should not begrudge the beginners the assistance they need. Let's take a point he made. He divides his radio in half. Well, I can do better



"I'd like to know if all of Mr. Burke's fellow servicemen were his equal. Of course, by and large they must have been good, but I have heard some officers complaining about the caliber of their technicians. All I ask Mr. Burke is, don't begrudge the beginner the help the authors generously extended. No hard feelings."

## A SERVICING CONTROVERSY

"It could be that the aforementioned service technicians have used Burke's method of alignment and so have misaligned the sets. However, his method is much better than a signal generator in aligning the r.f. and mixer grid circuit. I would like to know from Mr. Burke if the finger test, as he calls it, means touching the grid terminal and observing the amplitude of the hum output of the speaker."

—30—

**THREE** more television channels, besides hundreds of additional telephone calls, will be carried over the new *Bell System* coaxial cable that went into service the first of September. Although the New York-Philadelphia route already has more communication channels than any other served by the *Bell System*, the demand for facilities made necessary the addition of this, the ninth major cable between the cities.

Telephone and television signals are carried by small copper tubes, or coaxials. In the cable, which is about as large as a man's wrist, there are eight of these, a pair of which can carry about 600 simultaneous telephone messages or two video programs. In addition to the coaxials, ordinary telephone wires are packed into the cable to assist in controlling the operations and to handle short-haul telephone messages. —(30)

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1R5	43E5	01 3G	0BH0
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184	50-0G	0G6	0J6G
184	53	0B7G	0U5 6G5
175GT	56	077	0W4
2A5	51 25	7C5	0B6
2B0		7A7	12A
3H7		7G7	0Y3
3J5GT	1A5GT	12B0E	2AT7
3A5	1A6	12C8	14A7
6B36	1A7GT	14C6	14Q7
6D7	1A9G	20C5	11B7
6F5GT	1B7G	50C6	22
6G6G	1D7G	50C6	70L7GT
6F5GT	1D8G	20S0	
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67-7GT	1G4G	35B0	
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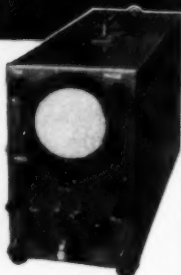
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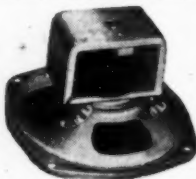
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Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

## SYLVANIA TECHNICAL MANUAL

The Radio Division of *Sylvania Electric Products Co., Inc.*, Emporium, Pa., has prepared a seventh edition of its technical manual, containing basic application data for 637 radio receiving tube types and cathode-ray tubes.

Informative data covers characteristic curves for tube types in common use, interchangeable tube charts, a dictionary of tube, circuit, FM, and television terms, and instructions on the use of characteristic curves.

Comprising 418 pages, the revised manual has a plastic ring-type spine that opens flat for convenience in reference work. Radio and television set repairmen, industrial electronic engineers, or others interested in this type of work may obtain the book from *Sylvania* distributors, or direct from *Sylvania Electric Products, Inc.*, Emporium, Pa.

## RELAY CATALOGUE

A sixteen page catalogue put out by the *H-B Instrument Company*, 2633 Trenton Ave., Philadelphia, Pa., illustrates and describes equipment used in signaling and controlling temperatures in both laboratory and plant installations. These include temperature controls, relays, thermometers, selector switches, and radio thermometers and thermostats.

"Double-Diamond" relays made by the company are available in two types, panel mounted types or the enclosed normally-open and normally-closed mercury relays; these have hermetically sealed contacts that accommodate 30 amperes at 115 volts a.c.

The booklet, which will be sent free of charge on request, is supplied with simplified price list, combined with the specification charts that furnish all needed information on the products.

## ANTENNA SYSTEM BOOK

*Jerrold Electronics Corporation*, 121 North Broad Street, Philadelphia 7, Pa., has prepared a booklet for its jobbers and dealers on the Mul-TV antenna system that permits the simultaneous operation of a large number of TV and FM receivers from one antenna.

The system can be adapted to any type of installation, from single channel to twelve channel operation. It is used non-amplified in strong signal areas or amplified in low signal areas and accommodates and properly matches any number of receivers intermixing 72 ohm or 300 ohm sets.

Although the basic design of the Mul-TV equipment would seem to per-

mit its use for apartment houses and hotels, the company does not recommend it for those installations and is working on some additional Mul-TV equipment for such applications.

## POWER POINTS

How electric power supplies have come to the rescue in situations where emergency electricity supplies were required is described in a 16-page magazine published by *D. W. Onan & Sons, Inc.*, Minneapolis, Minnesota.

Hospitals, public buildings, telephone companies, radio broadcasters, farms, hatcheries, and greenhouses have many times utilized the services of *Onan* power supply equipment to ward off serious losses that might have resulted from temporary power cut-offs during storms or other disasters. The magazine describes and illustrates these examples with many drawings and photographs, making on the whole an attractive as well as informative piece of work.

Those wishing a copy of the booklet, which is free of charge, should specify "Power Points," Vol. 5, No. 2.

## MACHINE TOOL GUIDE

A lavishly illustrated 16-page catalogue being offered by the *Walker-Turner Division* of the *Kearney & Trecker Corp.*, Plainfield, New Jersey, gives minute descriptions, prices, and complete specifications of the many types of metal and woodworking machine tools produced by this company.

Drill presses, shaft machines, grinders, lathes, motors, sanders, and pulleys are some of the many machines manufactured by the *Walker-Turner Division*, and described in this catalogue specified as "B." Still other heavier machines are described in a booklet entitled Catalogue "A," including ten-inch tilting arbor saws, twenty-inch drill presses, and variable speed wood turning lathes.

Both of these booklets are available direct from the company or any *Walker-Turner* dealer.

## ADHESIVE PRODUCTS PAMPHLET

*Paisley Products, Inc.*, 1770 Canalport Avenue, Chicago 16, Ill., has published a six-page illustrated pamphlet on the many varieties of adhesives used in industries such as home furnishings, electrical products, chemicals, etc.

In fabricating, assembling, labeling, wrapping, and sealing operations, these adhesives are utilized on appliances, dry batteries, fuses, motors, meters, wire and cable, and in the



manufacture of radios, phonographs, and sound equipment.

The ten main divisions of adhesives are described, and a product list shows uses and industries served. A free consulting service is offered by the *Paisley Laboratories* to users who may need assistance on certain problems, or who may require improvements in their regular operations.

#### ELECTRONICS BOOKLET

A brochure that describes industrial applications of electronic equipment has been issued by *RCA Victor*, Camden, New Jersey. Primary theme of the booklet is the advantages of less cost and greater profits accruing from the applications cited.

Comprising twenty pages, the literature describes fifteen types of equipment that are helping in the development and manufacture of new products and performing manufacturing operations more safely and with greater ease. It shows how leading industries are using sound systems, 16 mm. projectors, intercom systems, mobile equipment, tape recorders, industrial television, test and measuring equipment, and so forth. Other information is given on more than 40 complete lines of electronic products and services.

Entitled "Have You Thought of *RCA* for These Products?" the brochure may be obtained from the Public Relations Dept.

#### AMATEUR ANTENNA BOOK

The *E. F. Johnson Company* of Waseca, Minnesota, in the sixth edition of its *Antenna Handbook* recently issued, has compiled much valuable information along with directions on how to operate the rotomatic beam antenna.

Detailed sketches and photographs are scattered through the 47 pages of this book to illustrate the operation of the antenna rotator, antenna coupling, beam assembly and tuning, feed systems, impedance matching networks, and transmission lines, to name only a few of the subjects given.

Increased congestion of amateur frequencies leaves as the only alternative for improving operating conditions the use of directional antennas, this despite the advances made in transmitter design and increased ham station power.

The *Johnson Antenna Handbook* was intended, therefore, as a guide and help to the amateur in perfecting his arrays. Write the company at the above address for copies, which are 60 cents each.

#### ALLIED BUYING GUIDE

Recording equipment and accessories, including the latest wire, tape, and disc recorders, three-speed record players and changers, high-fidelity amplifiers, speakers, tuners, and other components for custom installations make up only a part of the 196-page catalogue recently put out by *Allied Radio Corporation*, 833 W. Jackson Blvd., Chicago, Ill.

Our 27th Year

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QUALITY - PRICE  
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#### 1/2, 1, 2 watt Resistors in Standard R.M.A.

Sizes, well known Mfrs. Brand New.

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1 watt Each	.10	per 100	8.50
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300 ohm lead	per 100 ft. 1.95
829 and 832 sockets	.39
1/4 to 1/2 shaft coupling	.12
S.P.S.T. 3 Amp. toggle switch	.21
S.P.D.T. 3 Amp. toggle switch	.24
Large insulated Banana plugs	.09
6 Gang 3 pos. ceramic switch	.69
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R58 Sockets	.08
2x2 879	.49
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100 Ft. coil #12 enamel	1.25
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110 volt Pilot Assembly	.39
110 volt-56 6 watt bulbs	.18
2J Differential Selyns	.59
Shure Crystal desk mike	5.00
100 Mmfid. split stator receiving condenser	3.82
National ACN Dial	3.23

#### TRANSFORMERS 115 Volts, 60 CYCLES

372-0-372 @ 175 Ma-SV @ 3 Amps	\$ 2.95
435-0-435 @ 250 Ma-80V @ Bias Tap	
5V @ 3A, 2.5V @ 3A, 6.3V @ 1.5A, 25V @ 10A	3.88
360-0-360 @ 250 Ma-6.3V @ 0.6A, 6.3V @ 8A, 5V @ 2A, 5V @ 3A	12.05
350-0-350 @ 200 Ma-6.3V @ 0.6A 6.3V @ 7A, 5V @ 2A, 5V @ 3A	8.67
400-0-400 @ 300 Ma-12.6V @ 10A.C.T. 5V @ 3A, 5V @ 6A	14.55
2500V @ 3 Ma-6.3V @ 3A tapped at 2.5V @ 2A, 2.5V @ 2A	5.14
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.0001 Mfd. 2500VDC mica	.25
500 Mfd. 200VDC electrolytic	.75
16 Mfd. 450VDC electrolytic	.69
Ceramic cond. from .75 MMfd to 2500 MMfd . . . per 100 assorted	10.00

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1.78 Mfd. 200VAC oil	\$ .29
1 Mfd. 600VDC oil	.29
2 Mfd. 600VDC oil	.39
7.5 Mfd. 330VAC oil	.69
2 Mfd. 1000VDC oil	.59
.05 Mfd. 2500VDC oil	.95
1 Mfd. 5000VDC oil	2.95
2x1 Mfd. 7000VDC oil	2.00
10 Mfd. 1000VDC oil	1.95
.25 Mfd. 6000VDC oil	1.69
.02 Mfd. 8000VDC oil	.98
.5 Mfd. 7500VDC oil	4.95

#### CHOKES

SMOOTHING	SWINGING	PRICE EACH
TYPE	TYPE	MA
C-80 10	C-87 4-16	150 \$3.09
C-81 10	C-88 4-16	200 \$3.82
C-82 10	C-89 4-16	250 \$5.29
C-83 8	C-90 3-14	300 \$5.59

All above 3000 Volts Insulation

#### ISOLATION TRANSFORMERS

All 117 Volts to 117 Volts 60 Cy.	
P-96, 40 watts \$3.40	P-98, 100 watts \$9.30
P-97, 80 watts \$5.18	P-99, 250 watts \$17.70

#### RAYTHEON VOLTAGE STABILIZERS

Positive Stabilization  $\pm 1/2\%$   
Input 95-130 volts, 60 cycles single phase; output 115 volts stabilized to  $\pm 1/2\%$ . \*Output 6.0 or 7.5 volts stabilized to  $\pm 1/2\%$ .



Catalog No.	Output Volts	Cap. Wt. lbs.	Net Price
VR-6110	15	4	\$15.00
VR-6101*	30	5	\$17.00
VR-6111	30	5	\$17.00
VR-6112	60	8	\$24.00
VR-6113	120	14	\$31.00
VR-6114	250	25	\$48.00
VR-6115	500	45	\$75.00
VR-6116	1000	92	\$125.00

#### FILAMENT TRANSFORMERS

Type 940 2.5VCT @ 10 Amps.	7500V Ins	\$2.79
Type 040 5. VCT @ 3 Amps.	2500V Ins	\$2.06
Type 941 5 VCT @ 6 Amps.	2500V Ins	\$3.38
Type 943 5 VCT @ 20 Amps.	2500V Ins	\$3.29
Type 946 6.3VCT @ 3 Amps.	2500V Ins	\$1.91
Type 947 6.3VCT @ 6 Amps.	2500V Ins	\$2.79
Type 948 6.3VCT @ 10 Amps.	2500V Ins	\$3.67
Type 960 7.5VCT @ 4 Amps.	2500V Ins	\$2.35
Type 143 7.5VCT @ 8 Amps.	2500V Ins	\$4.12
Type 146 10 VCT @ 10 Amps.	3000V Ins	\$4.99
Type 961 Dual 6.3VCT @ 3 Amps.	2500V Ins	\$3.38
Type 041 5VCT @ 3 Amps.	2500V Ins	\$3.38



**WIRE WOUND POTENTIOMETER**  
100,000 ohm, precision made G.E. type, 25 watt, 1/2" diameter Brand New \$1.95

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Cuts to 1/8" thick metal.	
1 1/2"	\$1.94
1 3/4"	\$1.94
1"	\$2.12
1 1/4"	\$2.25
1-3/16"	\$2.25
1 1/2"	\$2.88



#### SELSYN MOTORS

115 V.A.C. 60 cycle #C-78348  
Can be used to turn small in-  
creases or as indicators. Size  
3 1/2" x 5 1/2"  
Price per pair \$6.95

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For Small Transmitters. DC Voltage Ratings are Approx. Values  
Obtained at Output of a 2 section Choke input Filter. Using  
Mercury Vapor Rectifier Tubes Pri. is for 115 V. 60 cy.

Type	Sec. Rms. Volts	Sec. DC	DC Sec.	Dimensions			Price Each
				H.	W.	D.	
P 57	660-660+	500	250	4 1/4	3 1/2	4 1/4	\$ 6.76
	530-530	400					
P 58	1080-1080	1000*	125	4 1/4	3 1/2	5	8.33
	500-500	400	150				
P 59	900-900	750	225	4 1/4	3 1/2	5 1/4	7.94
	800-800	600					
P 67	1450-1450	1200	300	5 1/4	6 1/4	4	19.84
	1175-1175	1000					
P 68	2100-2100	1750	300	5 1/4	6 1/4	4 1/4	24.99
	1800-1800	1500					

\* For dual operation with simultaneous use of both sec ratings. † Has 40-volt bias tap.



#### SUPERIOR POWERSTATS

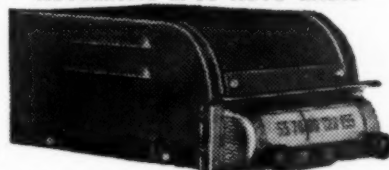
Smooth, efficient voltage control. 0 to 135V.  
output from 115V. AC line.  
Type 30 (illustrated 3 amps) \$12.50  
116 for table mtg 7.5 amps - 23.00  
116U for panel mtg 7.5 amps - 18.00  
1126 15 amps - 46.00  
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Also available for 230 volt input. Write for descriptive literature.

If not rated 25% with order, balance C.O.D. All prices F.O.B. our warehouse New York. No order under \$2.00. We ship to any part of the globe.

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GT. Glass and Miniature Types

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10A	6SA7GT	12SQ7
30A	6SQ7GT	25Z6GT
35A	6SK7GT	25L6GT
3V4	6SQ7GT	25L6GT

**\$33.95**  
Per 100

Also available in smaller quantities at 39c each.



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3", 4", or 5" PM, less output, Alnico  
S, each . . . . . 97c  
in cartons of 30, each . . . . . 87c  
6" x 9" Oval PM, Alnico S, 3.16 oz.  
magnet, each . . . . . \$2.59  
in cartons of 24, each . . . . . \$2.39  
TERMS: Net C.O.D., F.O.B. NYC.

MINIMUM ORDER \$10.00.  
Write for Bargain Catalog N-11  
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30 Church Street New York 7, N. Y.



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0.64 amp—28 volts, Reg. \$11.00 ea., SPECIAL \$1.99  
**350 TUBE SALE**—4 tubes min. #53-2A7-55.  
\$7.01A-85-31..... \$1.00  
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Jazz—Pop—Hillbilly—Polka..... \$1.99  
**WOOD MIDGET CAB.** 8 1/2"x5 7/8"x4 1/4"..... 69c

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COMPLETE COMPONENT PARTS for Heavy Duty Power  
Pack. Made from Signal Corps Brand New Parts—  
Delivers approx. 350 volts—150 ma. 1 Plate Trans.,  
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U. S. Gov't cost over \$80. Shipping wt. 30 lbs.  
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New Electronic Welding Process instantly welds burnt  
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63 Henries, .018 Amp., 930 Ohms..... 75c

**CONDENSERS**  
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K.C. (5 1/2"x5 1/2"x4")..... 35c  
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Signal Corps Phones—3 M. Ohms (8 M. Ohms  
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**OIL FILLED FILTER CONDENSERS**  
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Size 13 1/2"x2 1/2" ready to fit your cutting arm or  
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20-20 MFD. 150 V. 20c 40-40-20 MFD..... 30c  
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LOTS OF 12 (1 Type) 3c Disc. per Cond.

2 1/2 M.H. R.F. CHOKE COIL—27c ea. 5 for \$1.00  
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100 RESISTOR ASST. 1/4-1/2 WATT..... 95c

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Variable Condensers  
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5 Plate—20 MMFD..... 11c  
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4 PR. WAFER SOCKETS—\$1.49 per C. each..... 3c  
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2.000 ohm Wire Wound Rheostat..... \$1 per doz.  
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RCA 6 OHM POWER RHEOSTATS..... 39c  
PHILCO AUTO SUPPLY KIT—\$8.00..... 7c ea.  
GEN. ELEC. WESTINGHOUSE, etc. 60 CYCLE WATT  
HOUR METERS, slightly used, perfect condition,  
same as used in your home, 110-125 volts..... \$1.95  
5 Ampere..... \$2.95 10 Amps..... \$3.95

Grind your own crystals—Pure Brazilian Quartz, all  
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340-degree dial with 10 push button attachment—  
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3 gang, 3 pos. 3 band. 30c 6 gang, 5 pos. 4-5 band. 40c

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Trimmer-Padder Asst.—all Isolantia—singles, dual;  
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5"—450 ohm AC-DC dynamic..... \$1.35  
5" 5M OHM RCA SPEAKER..... 1.00  
Philco rotary tap tone control..... 25c

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Construct a U.S. Army Type of Metallic Mine Detector  
from these U.S. Army Mine Detector Amplifiers.  
Amplifier unit only (less tubes and batteries) with  
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Type AN/FRS-1..... \$1.95

TUBES—02A—79c; 117L7—89c; 215, same as 224  
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10 DRY ELEC. FILTER COND. ASST..... \$1.10  
6 ASST. WET ELECTROLYTIC CONDENSERS..... 59c

RADIO EXPERIMENTER'S SURPRISE PACKAGE—CON-  
TAINS BYPASS & FILTER CONDENSERS, SHORT  
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DRILLED CHASSIS FOR 5-6 tubes 7"x10"x1 1/2"  
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SALE—PHONO RECORD ALBUMS—SALE..... 49c  
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WESTERN ELEC. TRANSMITTING STEP-DOWN  
TRANSFORMER—AC 190, 210, 230, 250 V. W.E.  
20 AMP RETARD TO MATCH Wt. 125 lbs.  
ea. Freight Shipments Only. SPECIAL..... \$3.00 ea.

MINIMUM ORDER \$2.00—NO C.O.D.  
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scribes amplifiers and sound systems,  
from 8 to 80 watts, and some of the  
latest intercom, paging, and music  
units, together with a listing of all as-  
sociated components and accessories,  
such as microphones, pickups, speakers  
and baffles, phono motors, cable and  
connectors.

Besides the sound sections, the book  
lists every other component used in  
the radio, television, and electronic  
fields: test equipment, television and  
radio sets, TV parts, and some of the  
newest portable Geiger counters for  
uranium prospectors. A ham section  
lists "Everything for the Amateur,"  
receivers, transmitters, tubes, keys,  
transformers, etc. Experimenters and  
builders are not forgotten, and a wide  
variety of kits are pictured, one-tube  
units to 16" TV receivers, plus dia-  
grams, accessories and tools and sup-  
plies. Special kits and projects for use  
in radio training classes are also de-  
scribed.

This 1950 catalogue, "Everything in  
Radio and Electronics," is free of  
charge and will be sent on direct re-  
quest to the company.

### REPLACEMENT GUIDE

Just announced by *Standard Trans-  
former Corporation*, 3580 Elston Ave-  
nue, Chicago 18, Ill., is the third edi-  
tion of the firm's television replace-  
ment components catalogue, which is  
available from *Stancor* electronic  
parts distributors or direct from the  
company.

This bulletin DD338B gives chassis  
or model numbers of 37 manufactur-  
ers' sets, comprising 108 TV receivers,  
supplying the replacement components  
available on each arranged according  
to specification number; these include  
transformers, chokes, deflection yokes,  
focus coils, etc.

The guide is conveniently arranged,  
with holes to allow insertion in a note-  
book, and is the standard 8 1/2"x11 size  
when folded.

### PHOTOELECTRIC BULLETIN

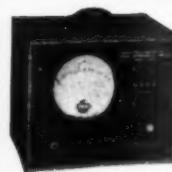
The *International Rectifier Corpora-  
tion*, 6809 S. Victoria Avenue, Los An-  
geles 43, California, has prepared a  
photoelectric cell booklet entitled Bul-  
letin PC-649, which contains diagrams  
and curves on photocells, besides de-  
scribing their construction and giving  
performance characteristics and appli-  
cations.

Current sensitivity, voltage output,  
internal resistance, spectral sensitivi-  
ty, etc., of this new line of selenium  
self-generating photocells are dem-  
onstrated by means of the curve draw-  
ings, and a price list that indicates the  
company's standard sizes, plus a dis-  
count schedule, are also included in  
Bulletin PC-649, which is available  
without charge on request.

### SUPERIOR EQUIPMENT

Tube testers, multimeters, kilovolt-  
meters, signal generators, volt-  
ohm-milliammeters, and combination  
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## Approved MODEL A-460 TELEVISION FIELD STRENGTH METER



**\$79.50  
ONLY**

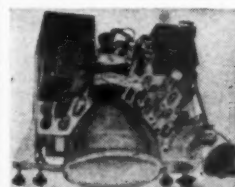
Model A-460 is  
housed in a heavy  
gauge steel cabinet,  
battleship gray fin-  
ish with 6 tubes  
(standard brands)  
IN34 Crystal, oper-  
ating instructions,  
circuit diagram and  
guarantee. Weight 25  
lbs., D-8" x H-10" x  
W-12".

Write for 12-page  
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Field Strength Me-  
ter; television 12  
channel tuner; vi-  
deo if channel;  
large 6" directly  
calibrated meter;  
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for locating anten-  
na systems; testing  
transmission lines;  
testing efficiency of  
indoor antennas;  
checking booster  
efficiency, etc.

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Completely wired and assembled ready to play. 31  
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mous RCA type TV receiver has a high gain tuner and  
video stages designed for excellent reception in distant  
locations. Vertical sweep compensated to give definite  
lock in. Frequency controlled to eliminate and mini-  
mize interference patterns in picture. Complete, with  
all tubes, less picture tube, \$169.50. Picture tube,  
15 inch 15AP4, \$49.50. Write for yours now.

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industrial electrical engineering, including radio, elec-  
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HAS THE  
SENSATIONAL NEW  
**TICO** 221-K  
VTVM Kit  
IN STOCK!

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2115 Prospect St. Cleveland 15, Ohio

Dear Sirs: Enclosed find check or money order in the amount of  
\$..... For which please send me the following:

No. 400-K @ \$39.95 No. 145-K @ \$18.95  
No. 221-K @ \$23.95 No. 311-K @ \$14.95  
No. 320-K @ \$19.95 No. P75-K @ \$ 3.75

Name.....  
Address.....  
City..... State.....

Please include 3% Ohio State sales tax.

## RADIO & TELEVISION NEWS



the new catalogue recently printed by Superior Instruments Company, 227 Fulton St., New York 7, N. Y.

Complete specifications with prices are given on each of these units. Besides the AM and FM radio testers and television test instruments, Superior's industrial and electrical equipment includes analyzers and utility testers for electrical contractors, maintenance men, motor repairmen, appliance men, etc.

One of the items featured in "The Superior Line for 1950" which should be of particular interest to sound technicians is a reflex projector, Model S-35, having a built-in driver unit. This speaker is rated at 35 watts and will handle up to 55 watts without blasting. It provides an 80-degree coverage, and this directional advantage, together with the high sound pressure produced, reduces the required driving power for any specific installation.

-30-

## Distortion Analyzer

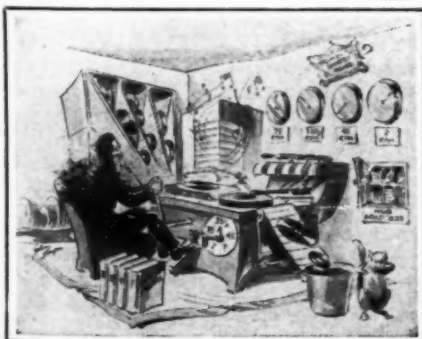
(Continued from page 45)

the system is balanced. Unfortunately, most 6N7 tubes have slightly different characteristics for the two halves, and it may be necessary to vary the individual plate voltages for best results. In no case should the input to the grids of the 6N7 exceed two volts. If greater output is needed, a 6J7 may be substituted for the 6J5 distortion amplifier.

Those experimentally inclined may be interested in adapting this system to the detection of intermodulation distortion. Intermodulation distortion in amplifiers is a case in which two audio frequencies combine to form an objectionable "beat" frequency. Many otherwise good amplifiers are quite poor in this respect, intermodulation distortion running as high as twenty-five per cent.

To make intermodulation tests, it is necessary to use two audio signals of different frequencies. These are fed into the amplifier under test and the output of the amplifier examined for "beats." Conventionally this is done by a series of filters rejecting the original frequencies and allowing the beat frequencies to pass. However, there seems to be little objection to suppressing the original frequencies in a manner similar to that used in the previously described distortion analyzer.

-30-



November, 1949

## SAVE 95% SENSATIONAL SURPLUS VALUES!



### TCB8 TRANSCEIVER

VHF Transmitter-Receiver 28-80 MC in 4 Bands Voice or MCW XTAL Calibrated on 130 Channels. Uses 2-30 Tubes. 1-1E7, & 1-959.

Comes with Carrying Trunk, Vibropack Headset and Mic. Ant. Spare Tubes. Instruction Book. Canvas Carrying Case. Like New. Orig. \$150.00 **\$49.50**

### ARC-5 /HF SET

R-55 RCVR. Superior operating on 4 channels. 100-110 MC. remote control w. 4 tubes. 1-12A5 3-12BH7 & 1-12X107 w. dyn. Originally \$85.00 **\$19.95**

MD-7 MODULATOR. Contains all necessary circuits & components for plate mod. of T-11 receiver w. dyn. which supplies plate & screen voltages for mod. Used. Originally \$38.50 **\$9.75**

7-11 XMITTER. MCW & phone on 4 channels. 100-110 MC. automatic turret tuning. 100% accurate remote controlled. 4 tubes. 2-12A5, & 2-12X107. Originally \$50.00 **\$13.95**

All Prices. Radio Control Boxes, etc. for ARC-5 2749 Equipment available at closed prices.

### ARB-RECEIVER

6 Tube, 4 Band Super Het Frequency Range. 195 Kc to 9 Mc.



Covering Range Broadcast, Boat and Amateur Frequencies. The Unit also has facilities for Loop Input with Tubes. Dynamometer. Used. Excellent. Originally \$150.00 **\$19.95**

### COMMAND XMITTERS

7-9.1 Used. Orig. \$50. New	\$ 8.50
T-22 ARC-5 7-9.1 New. Orig. \$50. New	10.50
3-4 MC Used. Orig. \$50. New	12.95
5.3-7 MC Used. Orig. \$30. New	3.95
T-21 ARC-5 5.3-7 New. Orig. \$40. New	5.50
4-5.3 MC Used. Orig. \$30. New	2.95
T-20 ARC-5 New. Orig. \$40. New	5.50
2-1.3 MC Used. Orig. \$40. New	7.50

### TUBE SPECIALS

5BP1 . . . \$1.95	6AC7 . . . \$1.95	872-A . . . \$1.95
3EP1 . . . \$1.75	6J6 . . . \$1.75	814 . . . \$3.75
12DP7 . . . \$9.95	6SN7 . . . \$9.95	Packed VT127A . . . \$2.95
836 . . . 2 for 99c	6AG5 . . . 69c	838 . . . \$3.75
816 . . . \$2.95	VR-105/30 . . . each	805 . . . \$5.00
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BC-223 AX XMITTER—Xtal controlled, w/2-3 Mc Tuning Unit, 15 Watts, w/Tubes. Brand New. **\$39.50**  
 BC-433 G COMPASS RCVR—Used with tubes **14.95**  
 RS-ARR-7 COMPASS RCVR—Used with tubes **18.50**  
 BC-348 RCVR—Used, excellent, checked. **69.50**  
 SCR-522—VHF Transceiver, 100-156 Mega. Used Good with new dynamometer and antenna. **39.50**

TA-12C XMITTER—Comes with MP-28 Modulator and Tubes. New **\$45.00**. Used. **\$32.50**  
 APS-13 ANTENNA. New. **\$14.95**  
 HEADSET ADAPTER. High to low impedance. **.89**  
 SCR-274N ANT. RELAY UNIT, contains 50 mmf. 6 KV Vacuum Condenser and 0-10 AMP. RF METER. Used, excellent. **\$1.95**  
 MC-299—Used for Replacing Dynamic Mike with Carbon **\$1.95**  
 ARR-2 RCVR., 234-258 MC. **8.95**

GO-9 XMITTER—Brand New with tubes for Hi Freq. and Mod. Unit only. Consists of 3 Units. HI FREQ. XMITTER 3000-18000 Kc Band Switching. 837 ECO, 837 BUFFER, and 803 FINAL AMP. LOW FREQ. SECTION uses 801 OSC., 807 Buffer, 803 Final Amp. Freq. Range 300-600 Kc. RECTIFIER UNIT 523 Low Voltage Rect., 2 Type 1016 H.V. Rect. Refer to surplus radio conversion manual for complete write up and conversion to 10 meters. **\$69.50**

### BC-1073 WAVEMETER

Tunes 150-210 Mc. uses cavity Tuner w/precision Millen gear drive tuning. Complete w/110 V AC 60 cy power supply and 19 tubes, like new. **\$24.50**

### INCREASE TUBE LIFE

28 V Blower operates on 24 V AC or DC, ideal for cooling those Final Bottles. **\$2.95**

APN-1 ALTIMETER TRANSDUCER. 1-8-462 MC FM. With dyn. & 14 tubes. Excellent cond. **\$5.95**  
 APN-1 INDICATOR. Basic Movement 0-1 MA. 5 MA. shunt. 270° dial. **\$1.95**

### VARIACS

2 KVA 0-130 V AC GEN R. **\$32.50**  
 5 KVA 0-130 V AC GEN R. **\$60.00**  
 500W 0-130 V AC GEN R. **\$14.95**

### XFORMERS

AUTO 1KVA 110-220 AC. **\$12.50**  
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 CHOKE 20 HY 300 MA 20 KV INSUL. **9.00**  
 AUDIO CHOKE OUNCER TYPE. 30 HY. **.49**

### CONDENSERS

Mica Type G-4 .0025 Mfd 25 KV Eff. **\$14.95**  
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 8-8-8 Mfd 600 WV. **1.79**  
 10 Mfd 600 V Oil Filled. **.89**  
 1 Mfd 10,000 V DC. **9.95**  
 2 Mfd 4000 WV DC. **4.00**  
 Dumont Type 224 Oscilloscope Pwr. Transformer. **\$11.95**  
 Leach Relay #1154 DPST 110 V 60 cy 10A New. **40.95**

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Infra-Red Image Converter Tube (British) to make "Snooperscopes," "Sniperscopes," and other devices that see in the dark. Operates with invisible infrared rays, without scanning or amplifiers. See October Radio-Electronics for interesting constructional article! Supplied with technical data and diagrams. Every tube guaranteed!

PRICE, EACH ..... \$ 8.00  
TWO FOR ..... 15.00

BAUSCH & LOMB Front-End Lens Assembly, for best images. F2.1, 3.5 in. E.F. EACH ..... \$12.00

MOUNTED LENS UNIT, also for front-end, results as good as B & L unit. Speed FL9, f.l. 91.44 mm, outside dia. at one end 60 mm, length of mount 64 mm. PRICE, EACH ..... \$9.00

### RCA 25-WATT MOBILE AMPLIFIER With RCA Dynamic Microphone

This is a swell buy for sound men, for installation in trucks, excursion boats, carnivals, etc. The unit operates from 12 volts DC (storage battery power). Is extremely compact, and delivers 25 watts peak power on speech or music with extremely good fidelity. Amplifier measures 11 1/2" x 8 1/2" x 6 1/2", and incorporates a 6J7 driving a 6SN7, driving 2-6L6 Beam Power tubes. A self-rectifying 12-volt vibrator pack is mounted within the amplifier. A fine close-talking dynamic hand microphone with cable and plug connector (all RCA mfr.) is also supplied. Value of this beautifully constructed equipment is over \$250.00. New, Surplus, and guaranteed!

New, Complete, Only \$42.50

### MARINE RADIO EQUIPMENT

NORTHERN RADIO Ship-to-Shore Radio-Telephones, 5 Channels 2-3 mc crystal-controlled, 65 Watts Output. Power Supply operates from 110 V. D.C. COMPLETE, with tubes, less accessories. Excellent cond. EACH ..... \$250.00

SUPREME TRANSMITTER CO., 100 Watt Radio-telephone 2-3 mc, 9 channels crystal-controlled. For 110 volts AC (supplied with converter) or DC. New cond. PRICE ..... \$575.00

32 VOLT DC to AC ROTARY CONVERTER, mfd. by Kato. For yachts, workboats, or farm installation. Output 110 V., 60 cycles AC, rated 225 watt but good to 300 watts. All NEW units.

PRICE, EACH ..... \$39.95

DECK ENTRANCE INSULATORS, bowl and flange type, 8 3/4" dia. with heavy galvanized metal flange and bell. Top bell 6 3/4" dia. 11 1/2" brass feed-thru rod. Very high voltage insulation. Individually packed in cartons, all NEW.

TEN FOR ..... \$15.00

DZ-2 DIRECTION-FINDING EQUIPMENT, with loop assembly, 28 V. DC operation, 15-70 & 100-1500 Kcs. NEW.

PRICE, EACH ..... \$150.00

### CLOSE-OUT BARGAINS!!

BC-322 WALKY-TALKY, 5 meter popular unit. Uses 2 tubes, types 30 and 33, and 5 mc crystal for calibration only and not necessary. All in operating condition. At this low price, supplied less tubes, crystal, antenna or handset. Limited Quantity. EACH ..... \$9.95

TS-11 HANDSET, for above, EACH ..... 3.95

TBY NAVY TRANSCIEVER, 28 to 80 mc. Excellent condition and complete with tubes, but less accessories or battery pack. EACH ..... \$32.50

BC-327A 2-3 MC BATTERY RECEIVER, Ruggedly constructed, with beautiful gear-drive vernier variable condenser. EACH ..... \$6.50

TYPE MP-22 SPRING-LOADED MAST BASE INSULATORS, Excellent for ship or car installation. Mount antenna (vertical) on this base, and swing to horizontal position when going under bridges or in garage.

EACH ..... \$2.95

RADIANT 12 V. DC VIBRATOR PACKS, type 6A10H, 200 volts at 90 ma output. EACH ..... \$4.75

SN-1/APQ-5 SYNCHRONIZER, NEW ..... \$24.95

BC-603 FM RECEIVERS, 20.0 to 27.9 mc. NEW with tubes. EACH ..... \$18.95

BC-604 FM TRANSMITTER, 30 W. output, companion to above. With tubes less MG. EACH ..... \$24.95

COMPLETE TRAY X-TALS for ABOVE ..... \$18.00

BC-654 FM TRANSMITTER, 27.9 to 38.0 mc. NEW with tubes and MG. 30 W. output, 12V. DC input. EACH ..... \$34.50

FT-737 MOUNTING PLATE, with connectors for installing above transmitters and receivers. NEW. EACH ..... \$9.95

DM-35 DYNAMOTORS, for above transmitters, 12 V. DC input, 625 V. DC at 225 ma output. EXCELLENT condition. EACH ..... \$8.50

PIONEER GEN-E-MOTOR, 18 V. DC input, produces 450 volts at approx. 100 ma. 6V. DC will produce 120 volts DC to operate electric shavers, etc. NEW.

EACH ..... \$2.75

Y-9 APQ-5 TRANSMITTERS, 40W A1, 200-550 mcs. New. EACH ..... \$24.50

GENERAL ELECTRIC AMPLIDYNE M.G. SET, generator type 2V-5875677, motor type 27AB58 New. 2CG-2ACU, 115-230V, 60c., motor rated at 3/4 HP. generator output 250V. DC at 375W. EACH ..... \$60.00

MT4 M.G. FOR 8025 TRANSMITTER, 111V. DC input, 575V. DC at 250 mcs and 55V. at .91 amps 500 cycle output ..... \$25.00

Mark II Hand Generators, delivers 162 volts at .03 amps, and 3.1 volts at .3 amps. Complete with seat pedestals, cranks, carrying bags, cords. Packed 4 to a case.

PRICE PER CASE OF 4 UNITS, NEW ..... \$30.00

GENERAL ELECTRIC AMPLIDYNE MODEL SAM78A97 MOTOR GENERATOR SET, Motor 2HP, 440V. 3 phase. Output 250V. DC at 3 amps, and 60V. DC at 12.5 amps. Excellent Condition. EACH ..... \$85.00

All Above Material Subject To Prior Sale, 25% Deposit With All C.O.D.'s.

— TELEMARINE —  
COMMUNICATIONS COMPANY  
280 Ninth Avenue  
NEW YORK 1, NEW YORK

# NEW EQUIPMENT FOR THE AUDIO TECHNICIAN

## LIGHTWEIGHT AMPRO RECORDER

Ampro Corporation, 2835 N. Western Ave., Chicago 18, Ill., has produced a tape recorder and play-back unit based on a new circuit design that permits a reduction in weight, size, and price.

Magnetic recording tape is used, operating on a "dual track" with either



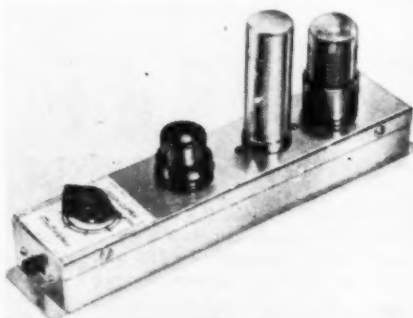
5 or 7 inch reels at a tape speed per second of 3 3/4 inches. A two-hour program may thus be placed on a single 7 inch reel of tape.

One of the features of the new device is a monitoring system that permits pre-setting the sound level before starting to record from radio or phonograph. Another advantage is the simplified threading and operating, whereby the tape is simply dropped into the single threading channel where it automatically centers itself and adjusts to proper tension.

Complete specifications on the Ampro recorder, including details on the timing indicator, erasure system, manual rewind for editing, etc., may be obtained from the company at the above address.

## ELECTRO-VOICE SPEECH CLIPPER

A preamplifier designed to provide higher articulation and intelligibility in amateur and other communication services by "clipping" the top and bottom from speech frequencies that rise above a pre-set amplitude has been in-



troduced by Electro-Voice, Inc., Buchanan, Michigan.

This model, called the E-V Speech Clipper, functions at approximately

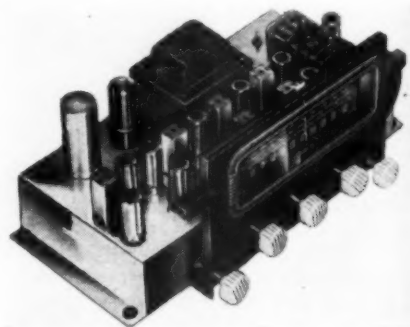
150 volts, with a required plate current of 5 ma. Frequency response is 200 to 3000 c.p.s. Operating directly from any high-impedance mike into the microphone input of a conventional speech amplifier, the speech clipper increases the ratio of consonant-to-vowel intensity and adds to intelligibility in speech transmission. This is accomplished by a pi low-pass filter providing attenuation of 24 db./octave on the curve above 3000 c.p.s. An "On-Off" switch makes possible the selection of conventional or "clipped" operation.

The case of this Model 1000 Speech Clipper is of aluminum, 10 1/4 by 2 by 4 1/2 inches in size, and the output terminal is an 18-inch shielded cable.

## AM-FM RECEIVER CHASSIS

The automatic frequency control with which the new AM-FM receiver combination of *The Radio Craftsmen, Inc.*, is equipped, is credited with simple and correct tuning of FM signals, eliminating all trace of side response and even superheterodyne images and adjacent channel interference.

The chassis of this Model RC-8, designed for custom installation, is of chrome, 9 by 15 by 7 inches in size,



weighing 19 pounds. All necessary interconnecting cables, escutcheon, mounting screws, diagrams, mounting templates, etc., are provided. Grouped on the front are five controls: bass, Off-On-Volume, AM-FM-Phono-Television, tuning, and treble. All audio controls are continuously variable.

Two input connections are provided for phonograph, television audio, wire recorder, etc., and are switched from the front, and two a.c. power outlets controlled by the "On-Off" switch supply the amplifier and phonograph motor. A rear socket provides easy access to 6.3 volt a.c. and well-filtered 100 v. d.c. for supplying external preamplifiers and additional pilot lights.

Power supply is a self-contained unit for 105-125 volt, 60 cycle a.c., and power consumption is 100 watts. FM frequency range for the slide-rule dial is 88-108 mc.; for AM, 540-1620 kc. Address *The Radio Craftsmen, Inc.*



1617 South Michigan Ave., Chicago 5, Ill. for further details on this chassis which may be had in rack and panel mounting at a slight additional cost.

#### MILES "RECORDALL"

For handling difficult reproducing jobs, such as conferences, telephone conversations, long-time dictation, court proceedings, etc., the Miles Reproducer Co., Inc., of New York has designed the "Recordall," a machine that may be set to run without supervision, voice vibrations being sufficient



to start the machine, which then automatically stops with a cessation of sound.

Several other unique features are incorporated in the unit, including automatic volume control, spontaneous selection of a designed soundtrack, automatic repeating for complete lines, automatic start and stop on split syllables, mobile or stationary operation, instantaneous playback, etc.

A vernier knob allows the operator to locate any point of an entire 3½

hour recording within a period ranging from a split second to 6 seconds. The dictator may sit, stand, or walk about while using the recorder, an advantage made possible by the ultra-sensitive pickup range.

Information on the "Recordall" will be sent by J. M. Kuchlik, Chief Engineer, Miles Reproducer Co., Inc., 812-814 Broadway, New York 3, N. Y.

#### AUTOMATIC FILM SPLICER

Handling all types of safety film bases, including the new tri-acetate stock, raw stock, and short ends, an automatic splicer for 35 mm. and 16 mm. motion picture film and magnetic tape in those sizes has been developed by the Prestoseal Manufacturing Corporation.

The machine, called the Presto-Splicer Professional Model, is simple to operate so that it can be used by comparatively unskilled persons and even in the darkroom. The splice, which does not add any thickness to the film, will hold up even under the process used for high-speed reproduction of TV, newsreel, and Ultrafax film. The complete operation cycle includes cutting, welding, cooling, and removal of film from the machine, and takes 6 to 10 seconds after editing.

A current control is provided to compensate for current variations, and there is a 2 by 3½ inch viewing light in the base. Maximum current consumption is 3 amps. for cycle

(Continued on page 176)

## MAKE EXTRA MONEY on PROJECTION TELEVISION!



#### SCHMIDT OPTICAL SYSTEM

for bright, large screen Television Projection

For 15" x 20" size picture, System No. 1 is required.

For 3' x 4' size picture, System No. 2 is required.

For 6' x 9' size picture, System No. 3 is required.

The above picture sizes can be varied (smaller or larger) to get exact dimensions required by simply twisting control in front of the barrel. For instance, on a 3' x 4' size the picture can be varied from below 2' x 3' to 6' x 4½'. Folder with complete information, dimensions and price of Schmidt System is available. Write for it now.

CORRECTING LENSES FOR SCHMIDT SYSTEMS AVAILABLE

15"x20"—3"x4"—6"x9"

Lenses are available for smaller or larger pictures. Send for prices.

#### NEW! SPELLMAN REGULATED 40 KV RF POWER SUPPLY

Available in voltage outputs 15-20 KV, 20-25 KV, 25-30 KV, 30-35 KV, 35-40 KV. Regulations of 1/10 of 1% at 1 mil. load. Ripple content less than 1% at maximum voltage. Regulation maintained within the limits 95 to 125 volts 60 cycles AC.

TUBE COMPLEMENT:

Regulators: 1—6L6

1—VR105

1—6AC7

Oscillators: 3—6L6

Rectifiers: 3—1B3

2—5U1

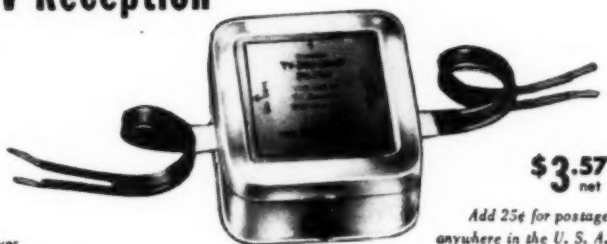


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## Improve TV Reception

with a Drake  
HIGH PASS  
FILTER



\$3.57  
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Add 25¢ for postage  
anywhere in the U. S. A.

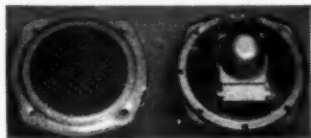
Easily installed in the 300-Ohm Antenna Lead-In at the TV Receiver, the Drake High Pass Filter improves TV reception by attenuating all signals from zero to 50 megacycles. Especially effective in suppressing interference entering the receiver at the I. F. frequency from any of the following sources:

Diathermy and X-Ray Equipment  
R. F. Heating Equipment  
Shortwave Broadcast Stations

Amateur Transmitters  
Electrical Appliances  
Static from Electrical Storms

In many fringe area installations the Drake High Pass Filter greatly improves picture reception by reducing noise pickup (snow) by the antenna and lead-in at the I. F. frequency.

#### Remote-Rear Seat Auto Speaker Kit



Complete Kit includes: • 5-inch PM Speaker with heavy pot • Grille Cloth and Wire Mesh Support • Attractive Metal Escutcheon with Gray Hammetone finish • Instructions for Installation. Small size permits installation in practically any make of car. Kit No. D-62K

sensationally low priced at only..... \$2.97 net

No. 2204 3-Way switch for selecting front speaker, remote speaker or both..... 30¢

#### 120 Watt Modulation Transformer

As used in the Army BC-191 and BC-375 Transmitters. Designed for Class B modulating a single 211 with push-pull 211's - 9000 ohm plate-to-plate impedance into a 7000 ohm load. With this transformer you can build yourself a good economical modulator for an 804, 814 or similar final. Net wt. 5 lb.

Stock No. D-371K  
Brand New only... \$1.49 ea.



#### Popular Amateur Transmitting Tubes

HK-24G ..... \$ .49

804 ..... 6.95

814 ..... 3.95

723A/B 10CM Klystron Tubes . . . \$8.95

GL-446A UHF Triode Lighthouse Tube  
good up to 500 Mc. Similar to 2C40 . . . 74¢ ea.

All Tubes are Brand New in the original  
factory carton and guaranteed.

FL-30 - 1020 Cycle Low Impedance

Audio Filters ..... 98¢ each

Terms - Cash with order or 20% deposit, balance C.O.D.  
Minimum order \$2.00.

All prices are net, F. O. B. Dayton, O.  
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STANDARD RADIO & ELECTRONIC PRODUCTS  
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## Now — IN KIT FORM

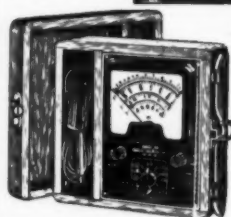
**EMC MODEL 300**  
VACUUM TUBE  
Volt-Ohm-Capacity  
METER

**\$23.95**



- Hammertone Metal Carrying Case
- DC VOLTS—6 ranges to 1000 volts!
- AC VOLTS—5 ranges to 1000 volts!
- RESISTANCE—6 ranges to 1000 meg-ohms
- CAPACITY—4 ranges (.000025 mfd to 20 mfd)
- ZERO CENTER POSITION
- INCLUDES LEADS

Completed Unit .....\$39.50  
CAPACITY RANGE and ZERO CENTER POSITION are features not available in competitive VTVM kits.



**EMC Model 120**  
20,000  
ohms-per-volt  
VOLOMETER

**\$22.95**

Portable Model Illustrated \$26.95  
The ONLY 20,000 ohms-per-volt instrument that gives you . . .

- 6 D. C. Volt ranges at 20,000 ohms/volt to 6000 volts
  - 6 A.C. Volt ranges at 10,000 ohms/volt to 6000 volts
  - 5 current ranges to 6 amps
  - 4 resistance ranges to 300 megs
- Completed Unit (open face).....\$29.95  
Completed Unit (portable).....\$34.95

**EMC MODEL 500K**  
R.F. SIGNAL  
GENERATOR

**\$18.75**



- Employs electrostatically shielded transformer for 115V 60 cycle operation.
- All coils not in use are automatically shorted out.
- Provision for external modulation.
- Attractive 3 color panel.
- Covers range from 150KC to over 30 megacycles on fundamentals—over 100 megacycles on harmonics.
- 400 cycle internal modulation available.

Completed Unit .....\$28.75

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Measurement  
Value per Dollar!

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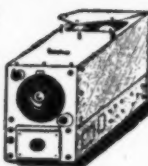
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## RADIO Surplus Buys

### COMMAND RECEIVER

Used, Good

BC 453-1.9-550 KC.....\$12.95  
BC 454-3-6 MC.....5.85  
BC 455-6.9.1 MC.....6.95  
6 1/4" CONTROL  
CABLE for above  
command sets ..... 1.00



Like New

R-5/ARN-7 COMPASS RECEIVER.....\$14.95  
BC-433G COMPASS RECEIVER ..... 14.95  
BC-603 FM RECEIVER..... 12.95  
BC-604 FM TRANSMITTER..... 15.95  
DY-9/ARC-1 DYNAMOTOR ..... 9.95

### ARC-4 VHF TRANSMITTING RECEIVER

140 to 144 Mc Crystal Controlled. 10 Watt Output. 13 Tube Receiver, containing 2 individual RF sections and a 10 Mc. IF Amplifier. Both RF sections may be operated simultaneously or either one individually. Less Crystal, \$5.95  
Dynamotor and Tubes. Used, Good...\$1.00  
ARC-4 SCHEMATIC .....\$1.00  
12 & 24 V Dynamotor for ARC-4..... 4.95

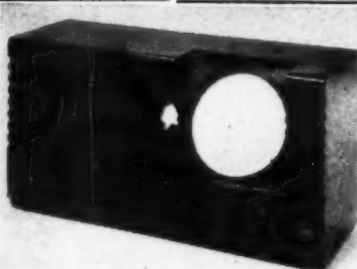
Pole and Tree Climbers (without straps) Used, D.C. \$1.50  
Lineman's Tool & Safety Belt (Web type) New 3.95

SEND 10c for complete surplus catalog.  
Enclose money with order. • All Equipment F.O.B.

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**AMATEURS! AMATEURS! AMATEURS!**  
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• Solid mahogany and veneer . . . hand rubbed finish . . . shipped prepaid, packed in original cartons. We have about 400 . . . \$1.98 each takes the lot—\$2.48 ea. for 200—or \$2.98 singly. 13 1/2" wide, 5" deep, 7" high; selection dial opening, 4" dia.; knob holes, 5/8" dia.  
IMMEDIATE DELIVERY!

**CABINETS, Box 1038, Lowell, Mass.**

period only. Power specifications are 110-120 v. a.c. at 50 to 60 cycles, with the primary circuit fused. Operation on 220 v. can be provided at a slight additional cost.

More complete specifications are obtainable from the company, located at 38-01 Queens Blvd., Long Island City, N. Y. Address Mr. Leonard A. Herzig, sales manager.

## CRYSTAL AND DYNAMIC MICROPHONES

A recent addition to the Turner Company's line of microphones is the Model 25X-25D, available with either crystal or dynamic circuits. All sound installations made with this new design are handled with smooth, wide-range frequency response and high output level. Features of both types are a 90 degree tilting head, 5/8 inch coupler mounting, and a quick-change cable set.

The crystal mike, Model 25X, has an effective output of 52 db. below 1 volt/dyne/sq. cm. with a flat response from 50 to 9000 c.p.s. and is equipped with



moisture sealed crystal. Model 25D, the dynamic type, has an output level of 54 db. below 1 volt/dyne/sq. cm. at high impedance with a flat response from 50 to 10,000 c.p.s. This mike is provided with Alnico V magnets. Microphone cases are finished in two-tone amber gray with a chrome plated grill or in bright chrome finish, whichever is desired. The Turner Company, Cedar Rapids, Iowa, will send more complete specifications on request.

## RADIO-RECORDER COMBINATION

Model C-2, a portable recorder-radio combination weighing only 30 pounds, is now being manufactured by the Pentron Corporation, 611 W. Division St., Chicago 10, Ill. To provide for maximum ease of operation, accessibility and economy of space, the company devised a special vertical mounting of the mechanism and chassis.

A dual-track mechanism has a recording speed of 7 1/2 inches per second, with a rewind ratio of 20 to 1. The chassis incorporates 7 tubes with 5

## MOBILE RIG?

ANTENNAS *Master Mobile* MOUNTS

**BODY MOUNT**  
MOD. 132  
NET  
**\$7.95**

**PRESENTS A QUALITY LINE OF MOBILE ANTENNA EQUIPMENT...Priced Right!**

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- have heavy shock absorbing springs for more broken or bent antenna whips, due to impact shock
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- have two types for body and bumper mounting installations—Unique design allows Body Mounts to fit any auto body contour—Bumper Mount clamps to bumper in few seconds.
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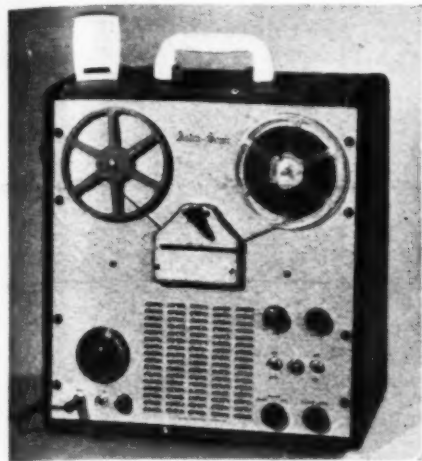
- are one piece centerless—ground tapered and designed to prevent excessive swinging—with stand rigorous treatment.

**BUMPER MOUNT**  
MOD. 138  
NET  
**\$5.95**

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**MASTER MOBILE MOUNTS, INC.**  
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General Sales Agent: Harry Appleton Co. 311 W. Pico Blvd., Los Angeles 15, Calif.  
"Dealer Inquiries Solicited"



watt power output rating, having a frequency response of 65 to 8000 c.p.s. plus or minus 6 db. A superheterodyne



receiver is included, encompassing the standard broadcast band.

The cabinet of the unit is of lock-corner plywood in two-tone simulated leatherette having bronze hardware and plastic trim, and the entire unit comes equipped with crystal microphone, tape, and takeup spool.

#### EICOR PORTABLE RECORDER

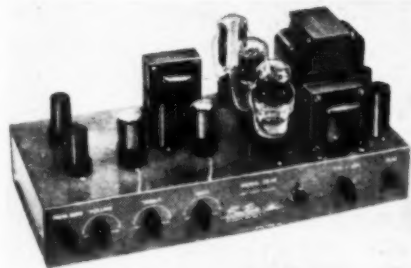
A luggage-type, portable tape recorder, weighing only 27 pounds and containing a five-tube amplifier with six-inch speaker, is now in production by Eicor, Inc., 1501 W. Congress St., Chicago 7, Ill.

A sensitive crystal microphone and radio speaker hookup are provided with this recorder, and there is ample storage space for extra tape, cords, and accessories. Although designed for portability and lower cost, the unit has the advantage of a frequency response equal to that of many higher-priced machines.

#### AMPLIFIER KIT

One of the newest developments of the Sun Radio and Electronics Company, Inc., 122-124 Duane St., New York 7, N. Y., is an all-triode, high-fidelity amplifier kit, Model CR-10.

The 10-watt, 7-tube unit, based on a



design published by Consumers' Research, Inc., Washington, N. J., provides flat frequency response, plus/minus 1 db., from 20 to 15,000 cycles, with distortion less than 2.5 per-cent. Gain is 75 db. on radio and 97 db. on phono.

Furnished with a punched, hammer-tone-gray-finished chassis housing, the kit comes complete with step-by-step

November, 1949

# BUY COMET OUTSTANDING VALUES!

### CODE EQUIPMENT

Tape Puller and Rewinder Bohme 4-P-FL... \$40.95  
Tape Puller Bohme 11F... 35.95  
Tape Bridge Bohme 4-5... 8.95  
Tape Stand McElroy TS-915... 1.45  
Practice Tapes—1 Hour Tape on 16MM Film Reel 400' for TG-10 Keyer... .75  
Tape Reel McElroy "Cum-sant" Metal 16MM 400' Capacity... .50  
Signal Ink Recorder SR 900 with Amplifier SR 900 Record Perfect Block Signal at Speeds Above 200 Words per Minute... 35.95

### CAPACITORS

40 mfd	25 VDC	\$0.30	\$0.25
50 mfd	50 VDC	.18	.10
120 mfd	120 VDC	.18	.10
2X .1 mfd	250 VDC	.20	.15
.05 mfd	600 VDC	.20	.15
2X .05 mfd	600 VDC	.23	.20
.25 mfd	600 VDC	.25	.20
.5 mfd	600 VDC	.25	.20
1 mfd	600 VDC	.25	.20
2X .1 mfd	600 VDC	.35	.30
1 mfd	600 VDC	.35	.30
2 mfd	600 VDC	.45	.40

### OIL-FILLED AND GE PYRANOL

5-.5 mfd	400 VDC	\$0.25	\$0.30
2 mfd	600 VDC <td>.35</td> <td>.30</td>	.35	.30
4 mfd	600 VDC <td>.55</td> <td>.50</td>	.55	.50
5 mfd	600 VDC <td>.60</td> <td>.55</td>	.60	.55
6 mfd	600 VDC <td>.60</td> <td>.60</td>	.60	.60
8 mfd	600 VDC <td>1.00</td> <td>.90</td>	1.00	.90
1-.8 mfd	600 VDC <td>1.20</td> <td>1.10</td>	1.20	1.10
10 mfd	600 VDC <td>1.10</td> <td>1.00</td>	1.10	1.00
10 mfd	680 VDC <td>4.95</td> <td>4.75</td>	4.95	4.75
12 mfd	680 VDC <td>4.95</td> <td>4.75</td>	4.95	4.75
15 mfd	680 VDC <td>4.95</td> <td>4.75</td>	4.95	4.75
4 mfd	700 VDC <td>.65</td> <td>.60</td>	.65	.60
.5 mfd	2000 VDC <td>1.10</td> <td>.90</td>	1.10	.90
.5 mfd	3000 VDC <td>1.95</td> <td>1.60</td>	1.95	1.60
.5 mfd	3000 VDC <td>2.00</td> <td>1.70</td>	2.00	1.70
1 mfd	7500 VDC <td>2.60</td> <td>2.30</td>	2.60	2.30
1 mfd	12,000 VDC <td>9.50</td> <td>9.00</td>	9.50	9.00
00008	15,000 VDC <td>6.95</td> <td>6.50</td>	6.95	6.50
.2 mfd	15,000 VDC <td>12.95</td> <td>12.95</td>	12.95	12.95
.045 mfd	16,000 VDC <td>4.15</td> <td>3.25</td>	4.15	3.25

### PAPER

8-8 mfd	600 VDC	\$1.00	\$0.90
Tube Filtermate <td></td> <td>1.45</td> <td>1.25</td>		1.45	1.25
3x8 mfd <td>600 VDC <td>1.45</td> <td>1.25</td> </td>	600 VDC <td>1.45</td> <td>1.25</td>	1.45	1.25
8-8-4 mfd <td>650 VDC <td>1.45</td> <td>1.25</td> </td>	650 VDC <td>1.45</td> <td>1.25</td>	1.45	1.25

### ELECTROLYTIC

2500 mfd	3 VDC	\$0.15	\$0.10
25 mfd <td>25 VDC <td>.20</td> <td>.15</td> </td>	25 VDC <td>.20</td> <td>.15</td>	.20	.15
1000 mfd <td>25 VDC <td>.85</td> <td>.80</td> </td>	25 VDC <td>.85</td> <td>.80</td>	.85	.80
150 mfd <td>50 VDC <td>.25</td> <td>.20</td> </td>	50 VDC <td>.25</td> <td>.20</td>	.25	.20
500 mfd <td>200 VDC <td>1.00</td> <td>.90</td> </td>	200 VDC <td>1.00</td> <td>.90</td>	1.00	.90

### F-3-L SANGAMO X-MITTING MICA

Mfd	Amps	Volts	Pa.	Ten
.007	12	5000	\$2.60	\$2.20
.006	11	6000	4.10	3.80
.002	7.5	8000	3.95	3.55
.003	10	8000	4.70	4.30
.004	10	8000	5.25	4.85
.005	11	8000	5.65	5.10

### DE-ION LINE STARTER

DPST 115V 60CY Westinghouse Type DN size C Class 15-825.0 NEW... \$3.25

### SPECIALS

80-80 KC Crystal in Holder... \$1.50  
100 KC Crystal in Holder... 1.35  
CD-501A Cord Connects BC-654 Transceiver to GN-45 Gen. Balloon with Hydrogen Generator... 2.50  
30 Watt Tube Socket 872-211 PL-150 Plug for Dynamotor BC-225... .19

### SPECIALS

BC-929 3" Scope Indicator NEW \$10.95  
BC-906 D Frequency Meter 150-225MCs Absorption Type NEW \$10.95  
BC-312 Receiver, USED \$69.55  
BC-224 Receiver, NEW \$100.00  
BC-709 Interphone Amplifier-Ideal for Aircraft, Booster Telephone... NEW \$4.25  
RA-10DB Receiver Bendix NEW \$34.30  
SCR-627 Radar Receiver Indicator... NEW \$400.00  
RF Tuning Unit for BC-444 X-Mixer... NEW \$175.00

### SUPER PRO TUBE KIT

1-6X7 1-6X7 1-6X7  
1-6C5 1-6SN7 1-R0  
2-6H6 3-6SK7 1-5Z3  
3-6F6 PRICE... \$8.50

### TUBES

2C34	\$0.25	2051	\$0.40
2C44	.55	9002	.35
2X2A	.55	9003	.35
2X2 870	.35	9006	.35
3C24	.35	8BP1	1.30
3E29	7.95	5BP4	2.90
7C4/1203A	1.35	5CP1	1.75
10Y	.45	5FP7	1.00
15E	1.50	5CR	7.75
15R	.75	CE072	1.30
45 SPEC.	.28	CRP 72	1.25
54 GAM.	4.50	HY 60	2.10
211	.45	HY 615	.25
304TH	3.40	8K22	1.95
450TH	17.50	8K73	.95
713A	.90	VT-127A	2.25
750 TL	43.50	126 G	.85
803	4.25	2A3	.85
805	3.75	3A4	.35
807	1.00	3Q4	.35
810	.60	6A25	.75
826	.40	6T4	.25
830BT	3.45	6H6	1.10
872A	1.45	6K6 GTG	.45
957	.20	6XG7	.60
CK1005	.35	6SR7	.60
E1148	.35	12A6	.20
1676	.35	25 L6 GT	.55
1629	.35	25L5	.45

### IF TRANSFORMERS .49 EACH

226 KC... .45 KC  
385 KC... .52 KC  
300-410 KC... 5.25 MC

### ROTARY SWITCHES

Pole	Position	Section	Shaft	Price
2	4	6	1/8"	\$0.30
4	10	4	1/8"	.30
2	8	2	2 1/8"	.30
4	10	2	3/4"	.35
4	12	2	4"	.40
2	8	2	3/8" 9KVA	FLASH OVER 1.45
2	12	3		.50
3	3			
2 Pole	2 Circuit	6 Cont w/ Knob		.33

### WIREWOUND

Cat. No.	Ohms	Watts	Linear	Shaft	Wfr.	Pa.	Ten
003P5	5000	2	Linear	1/8"	17 1/2"	Wirt	\$0.30 \$0.25
048P1	50	25	Linear	1/8"	19 1/2"	DeJor	50 .40
K2017	100	25	Linear	1/8"	19 1/2"	IRC	55 .45
148B2	1000	25	Linear	1/8"	19 1/2"	DeJor	55 .50
032	3000	25	Linear	1/8"	19 1/2"	DeJor	65 .55
155B1	15,000	25	Linear	1/8"	19 1/2"	DeJor	70 .65
105	20,000	25	Linear	1/8"	19 1/2"	DeJor	85 .70
OHMITE	800	50	Linear	1/8"	19 1/2"	Ohmite	1.10 .95
079	400/400	50	Linear	1/8"	19 1/2"	DeJor	1.10 .95
024	10,000	50	Linear	1/8"	19 1/2"	DeJor	1.50 1.25
IRC	15	75	Linear	1/8"	19 1/2"	IRC	1.50 1.25
OHMITE	750	150/Knob	Linear	1/8"	19 1/2"	Ohmite	2.45 2.10
HELIPOT	20,000	0.5 5% 5	Linear	1/8"	19 1/2"	Gibbs	4.50 4.00
094	200	3	Linear	1/8"	19 1/2"	Chic. Tel.	25 .20
036B2	1000	3	Linear	1/8"	19 1/2"	Trefz	25 .20
039B3	5000	3	Linear	1/8"	19 1/2"	Trefz	25 .20
096	7500	3	Linear	1/8"	19 1/2"	Trefz	25 .20
023B2	10,000	3	Linear	1/8"	19 1/2"	Trefz	30 .25
097	10,000 DVAL	3	Linear	1/8"	19 1/2"	Trefz	35 .30
063	20,000	3	Linear	1/8"	19 1/2"	Trefz	30 .25
098	20,000	3	Linear	1/8"	19 1/2"	Trefz	25 .20
065B10	25,000	3	Linear	1/8"	19 1/2"	Wirt	30 .25

### POTENTIOMETERS

Cat. No.	Ohms	Watts	Linear	Shaft	Wfr.	Pa.	Ten
003P5	5000	2	Linear	1/8"	17 1/2"	Wirt	\$0.30 \$0.25
048P1	50	25	Linear	1/8"	19 1/2"	DeJor	50 .40
K2017	100	25	Linear	1/8"	19 1/2"	IRC	55 .45
148B2	1000	25	Linear	1/8"	19 1/2"	DeJor	55 .50
032	3000	25	Linear	1/8"	19 1/2"	DeJor	65 .55
155B1	15,000	25	Linear	1/8"	19 1/2"	DeJor	70 .65
105	20,000	25	Linear	1/8"	19 1/2"	DeJor	85 .70
OHMITE	800	50	Linear	1/8"	19 1/2"	Ohmite	1.10 .95
079	400/400	50	Linear	1/8"	19 1/2"	DeJor	1.10 .95
024	10,000	50	Linear	1/8"	19 1/2"	DeJor	1.50 1.25
IRC	15	75	Linear	1/8"	19 1/2"	IRC	1.50 1.25
OHMITE	750	150/Knob	Linear	1/8"	19 1/2"	Ohmite	2.45 2.10
HELIPOT	20,000	0.5 5% 5	Linear	1/8"	19 1/2"	Gibbs	4.50 4.00
094	200	3	Linear	1/8"	19 1/2"	Chic. Tel.	25 .20
036B2	1000	3	Linear	1/8"	19 1/2"	Trefz	25 .20
039B3	5000	3	Linear	1/8"	19 1/2"	Trefz	25 .20
096	7500	3	Linear	1/8"	19 1/2"	Trefz	25 .20
023B2	10,000	3	Linear	1/8"	19 1/2"	Trefz	30 .25
097	10,000 DVAL	3	Linear	1/8"	19 1/2"	Trefz	35 .30
063	20,000	3	Linear	1/8"	19 1/2"	Trefz	30 .25
098	20,000	3	Linear	1/8"	19 1/2"	Trefz	25 .20
065B10	25,000	3	Linear	1/8"	19 1/2"	Wirt	30 .25

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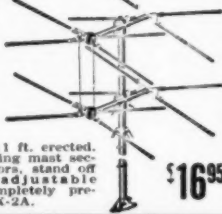
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**Unbeatable T.V. Reception**  
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Quick To Install.  
 Just unfold, tighten  
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Extremely hi-gain.  
 Recommended for  
 fringe areas. Easily  
 stacked double con-  
 ical Lazy X type.  
 All channels plus  
 FM. Overall height 11 ft. erected.  
 Complete with 3 mating mast sec-  
 tions, guy wire anchors, stand off  
 pole insulators and adjustable  
 mounting base. Completely pre-  
 assembled. Model TX-2A.



\$16<sup>95</sup>

### T.V. ANTENNA ACCESSORIES

LIGHTNING ARRESTORS, RCA Strap-on style. For 300 ohm lead.	\$ 0.68
STEEL EXTENSION POLES, 3 1/2 ft. long, 1 1/2" di., crimped to fit inside ant. mast.	.75
10 FT. ALUMINUM POLES 1 1/2" di.	1.95
ANTENNA SWIVEL BASE, Aluminum	.39
GUYWIRE, 6 stranded No. 20, Per 50 ft.	.29
24 reels, 50 ft. each, interconnected.	6.00
72 OHM COAXIAL CABLE RG59U (4c per ft.) 100 ft.	3.75
300 OHM TWIN LEAD (\$1.45 per 100 ft.) 1000 ft.	11.75
CHIMNEY MOUNT BRACKETS, Complete with strap	1.98
HI-BAND ADAPTER, Folded dipole and re- flector. Clamps on existing pole	2.00
3 1/2"-300 OHM STAND OFF INSULATORS, Wood screw-in type, 3c ea, per hundred.	2.75
SANS TV ANTENNA MANUAL	1.75

### Sensational Antenna Buy! SNYDER HI-LO ARRAY

Model T.V. 21



\$5<sup>95</sup>

We don't believe you'll  
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 where near this low  
 price. Two folded di-  
 poles (High & Low)  
 with reflectors. Com-  
 plete with two 3 1/2" mast sec-  
 tions, guy ring, standoff insu-  
 lators. Ready for easy, quick  
 installation.

### T.V. ANTENNA Matching Transformer

72 to 300 Ohm  
 Model T-72

Matches 72 ohm coaxial cable (such  
 as RG59U) to 300 ohm receivers.  
 Voltage step-up of 2:1 with a flat  
 response over the T.V. channels from  
 52 to 216 mc.

\$2<sup>40</sup>



### WHEELER Sound Powered TELEPHONE HANDSET

No Batteries • No Power Supply Needed



Satisfactory operation up to 25 miles  
 with  $\pm 16$  twisted wire; up to 19 miles  
 with  $\pm 19$  twisted. High fidelity speech  
 transmission. Perfect for  
 stores, shops, homes and  
 installations of radio and  
 T.V. antennas. Order model  
 SPT-102.

\$8<sup>75</sup> each

\$17.50 per set of two.

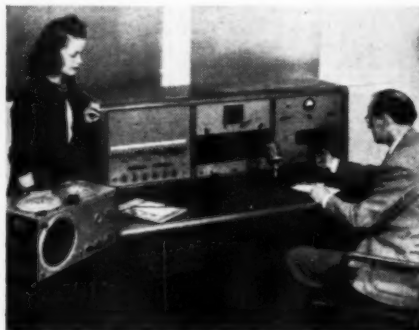
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 Mulberry 2134

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**RADIO PARTS CO., Inc.**  
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instructions, photographs, and dia-  
 grams, for the price of \$42.50. Assem-  
 bled, wired, and tested, the unit is  
 \$69.50.

### SOUND DISTRIBUTION SYSTEM

Latest device announced by the  
 Webster Electric Company of Racine,  
 Wisconsin, is a two-channel unit called  
 the "Teletalk," (SS-271A) providing  
 for communication, radio and phono-



graph distribution, voice reinforcement,  
 announcements, etc., all in the  
 one console.

One of the channels provides for  
 AM-FM radio and phonograph recep-  
 tion while the other is used for gen-  
 eral announcements, as an amplifier  
 unit, or even as a separate reproducer.  
 Communication may be made to indi-  
 vidual rooms without interfering with  
 program distribution to other loca-  
 tions, and an "All-Call" switch per-  
 mits simultaneous announcements  
 when desired. Communication from  
 individual rooms to the central control  
 is also possible.

### LIGHT-WEIGHT WIRE RECORDER

A wire recorder possessing the ad-  
 vantages of speed in spool changing  
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 complete portability, is one of the  
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 to be run from the machine to a micro-  
 phone installation six or seven blocks  
 away. Another advantage making for  
 speed in operation is a removable  
 turntable that can be changed in 15  
 seconds without immediate rewinding  
 of the tape. The cue meter is cali-  
 brated in minutes, and the operator  
 may listen via the microphone before  
 starting the recorder at the point de-  
 sired.

Los Angeles police collaborated in  
 the manufacture of this device and  
 have already installed it at headquar-  
 ters, to be used by the detective force.  
 To disguise the machine, the company  
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tively-styled cabinet in period or modern designs. Characteristics of the reproducers are excellent transient response and non-resonant horn loading for clear definition.

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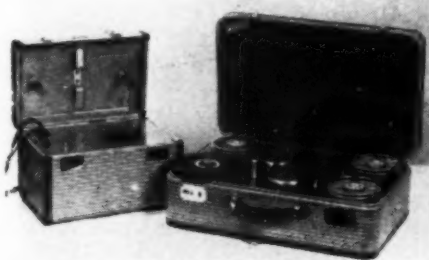


from 30 to 15,000 cycles are cleanly distributed. Driver units provide excellent reproduction of extreme bass tones, a better balance than formerly attained in the middle ranges, and a smooth and flat frequency response to 15,000 cycles.

#### "PRINTING" TAPE RECORDINGS

A simplified method for duplicating magnetic tape recordings on either paper or plastic tape was introduced recently by the *Minnesota Mining and Manufacturing Co.* of St. Paul, Minn., at the National Electronics Conference in Chicago.

Sound is created on magnetic tape by means of patterns formed in the iron oxide dust coating, and the demonstration was accomplished by bringing together two tapes, one recorded and one "blank," in the presence of an A.C. magnetic field. The "printing" was done with a device consisting of two units, each weighing 25 pounds. One of these is comprised of a motor, a



magnet, and a mechanism that winds the master tape and the "blank" together. The second unit is an oscillator generating 2000 cycles in the electromagnet.

For mass production such a "contact printing" machine could make a dozen or more duplicate recordings simultaneously from a single master tape. Stressing the fact that any figure on costs would be only guesswork, it was estimated that a machine of this type could cut production time for a one-hour recording down to a matter of seconds.

-30-

November, 1949

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1A3	\$.80	5X4G	\$.65
1A4P	1.40	5Y3GT	\$.45
1A5GT	1.15	5Y4G	\$.54
1A6	1.15	5Z3	\$.65
1A7GT	1.22	5Z4	\$.96
1B4P	1.40	6A3	\$.96
1B5/25S	1.15	6A4/LA	1.15
1C5GT	1.15	6A6	\$.96
1C8	1.15	6A7	\$.72
1D5GP	1.40	6A8GT	1.15
1D7G	1.15	6A87	1.15
1D8GP	1.40	6AC7	\$.96
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1E7GT	1.40	6AF6G	\$.96
1F4	1.15	6AG5	1.15
1F5G	1.15	6AG7	1.15
1G4	1.15	6AK5	1.25
1G6GT	1.15	6AL5	1.15
1H4G	1.15	6AL7	1.15
1H5GT	1.15	6AQ7	1.15
1H6G	1.15	6AT6	1.15
1J6G	1.15	6B4G	1.15
1L4	1.15	6B7	1.15
1LA4	1.15	6B8G	1.15
1LA6	1.15	6C4	1.15
1LB4	1.15	6C5	1.15
1LC3	1.15	6C6	1.15
1LD5	1.15	6C8G	1.15
1LE3	1.15	6D6	1.15
1LH4	1.15	6E5	1.15
1LN5	1.15	6F5GT	1.15
1P5GT	1.15	6F6	1.15
1P5GT	1.15	6F6G	1.15
1O5GT	1.15	6F7	1.15
1R4	1.15	6F8G	1.15
1R5	1.15	6G6G	1.15
1S4	1.15	6H6GT	1.15
1S5	1.15	6J5GT	1.15
1T4	1.15	6J6	1.15
1T5GT	1.15	6J7	1.15
1V	1.15	6K6GT	1.15
2A3	1.15	6K7	1.15
2A6	1.15	6L6	1.15
2A5	1.15	6L5G	1.15
2A6	1.15	6L6	1.15
2B7	1.15	6L6GA	1.15
2X2	1.15	6L7	1.15
3A4	1.15	6N7	1.15
3D6/1299	1.15	6P5GT	1.15
3Q4	1.15	6Q7	1.15
3Q5GT	1.15	6R7	1.15
3S4	1.15	6S7	1.15
5R4GY	1.15	6S8GT	1.15
5T4	1.15	6S87-Y	1.15

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6SH7	1.15	7A4	1.15
6SJ7	1.15	7A5	1.15
6SK7GT	1.15	7A6	1.15
6SL7GT	1.15	7A7	1.15
6SN7GT	1.15	7A8	1.15
6SQ7	1.15	7B4	1.15
6SR7	1.15	7B5	1.15
6SS7	1.15	7B6	1.15
6ST7	1.15	7B7	1.15
6SV7	1.15	7B8	1.15
6T7G	1.15	7C3	1.15
6U5	1.15	7C6	1.15
6U6	1.15	7C7	1.15
6U7	1.15	7E6	1.15
6V6	1.15	7E7	1.15
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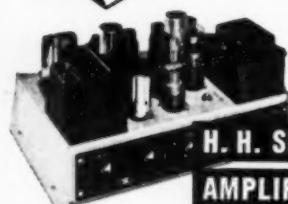
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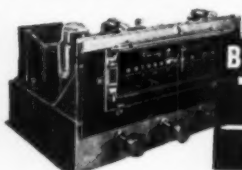
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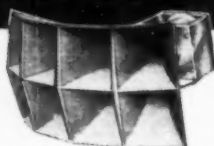
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## International Short-Wave

(Continued from page 151)

in parallel. RAI has expanded its "Publicity Program" to five minutes; this commercialization of an international broadcast is, in the opinion of Worris, N. Y., who reports the item, "one of the most fascinating developments in s.w."

**Japan**—Press dispatches indicate that unrestricted international broadcasting has been authorized for Japan. (Fried, Mich.) Can anyone confirm this?

**Kenya**—VQ7LO, 4.885, Nairobi, heard with relay of BBC news 1315; talk followed, then station identified 1330, followed by light music. (Short-Wave News, London)

**Luxembourg**—Radio Luxembourg, 6.090, transmits daily 1130-1630; English programs (relayed from the l.w. station) are 1130 Sam Costa Show (Sundays); 1200 latest records; 1230 Pin-Up Princess for a Day, Stewart MacPherson; 1530 request program; 1600 Jack Jackson show. (Short-Wave News, London.) They may mean all these for Sundays only?

**Madagascar**—FIQA, Radio Tananarive, 6.060, is difficult to pick up but sometimes can be heard in Sweden with weak signal during the last half hour of the daily transmission which ends 1400; dance music; closes with "La Marseillaise" and then three times plays some tunes on an oriental instrument; severe QRM noted from Russian jamming transmitters on either side. (Albinsson)

**Malaya**—British Far Eastern Broadcasting Service, 9.69, Singapore, heard 0700 relaying BBC. (Stark, Texas)

**Radio Malaya**, 4.780, Singapore, heard in New Zealand to 1030 sign-off after broadcast in Chinese. (Cushen.) The 7.20 outlet has program summary 0530, news, and music. (Sanderson, Australia.) Sent verification on the 7.20 outlet, and listed schedules—daily 2330-0130 Chinese and Indian, 0430-1030 Chinese, Indian, Malay, on 6.135, 4.780; daily 2330-0030 Malay on 7.20, daily 0030-0130 English on 7.20, daily 0530-1030 English on 4.825; Saturdays 0130-0425 English on 6.135, and 0425-1100 English on 4.825; Sundays 2030-2330 English on 6.135, and 0130-0425 English on 6.135, and 0425-1030 English on 4.825. (Fellers, Japan)

**Malta**—Pearce, England, airmails this data regarding a station on 4.785 announcing "You are tuned to the Forces Broadcasting Service, Middle East." Test transmission first logged 1510 on August 4; call at end of programs. At 1600 gave call and time as 2100 GMT. No further announcement and carrier left the air 1608. On August 7 was logged 1420; recorded program from BBC; relay of BBC's General Overseas Service; call at intervals including 1425 and 1525, when said: "This is a test transmission from the Forces Broadcasting Service, Middle East"; carrier remained to 1605

after final call and time at 1600. On August 12 was heard as early as 1325 with "Sporting Review"; at 1330 relayed Promenade Concert from BBC; continued on air and was still operating 1710 when was tuned out. At the time this was compiled was being heard only irregularly around 1300-1330. A letter received by Pearce some time ago from Forces Broadcasting Service, Middle East, Benghazi, Lybia, acknowledging his report on tests over 4.782, said there was a possibility of future broadcasts either from Benghazi or from Malta. This is more likely at Malta now, I believe. Carlberg, Sweden, airmails that he has heard this station on approximately 4.780 closing down 1400, and that location sounded like "Malta."

**Manchuria**—Harbin, 7.100, now relays the Peiping New China programs, carrying the same news in English 0830. A station heard on approximately 5.520-5.530 is believed to be Mukden, Communist-controlled; schedule is unknown but is heard before 0700; at 0730 takes Peiping relay to 0830 but does not carry English then; instead, plays Chinese music; signs off after 1000; has news at dictation speed (presumably in Chinese) before and after 1000. Dilg, Calif.)

**Monaco**—Short-Wave News, London, reports—"Radio Monte Carlo, 6.035, 9.785, is one of the best s.w. broadcasters from the reliability point of view to be heard at the present time in Britain. First-class program material is available all day from 0200 to 1815 (may sign-off now 1715?—KRB); a special English program of one hour's duration is radiated Sundays at 1700." The 31-m. channel varies from day to day; measured 9.786.3, according to Oskay, N. J., via URDXC.

**Mozambique**—At the time this was being compiled, CR7BJ, Lourenco Marques, had moved up slightly to around 9.66, although at times has been as high as 9.68; QRM'd by XEQQ in the Portuguese transmission beginning 0000. (Balbi, Calif.) CR7BU, 4.825, heard 1430 with three chimes interval signal and announcement, "Radio Clube de Mozambique"; CR7BV, 4.930, heard in Portuguese 1515, but signals suffer CWQRM in London. (Short-Wave News, London)

**New Caledonia**—Radio Noumea, 3.410, still heard in New Zealand at fair strength to 0500 close down. (Cushen.) The paralled station is on approximately 6.000.

**New Zealand**—ZL3, 11.81, is excellent in East 0600 when relaying BBC news; leaves the air around 0620-0630. Cushen, N. Z., says ZL3 is using the 11.81 channel at times to escape QRM from Saigon (both ZL3 and Saigon are allocated 11.78). A new channel for ZL2 (listed 9.540) is 9.620 used recently for rugby relays from 0830, Cushen reports. At times, however, ZL2 has also been noted on 9.780.

**North Korea**—JBBK, 4.400, Pyongyang, not heard in past several weeks; former dual outlet, 7.784, is fair mornings. (Balbi, Calif.)

**RADIO & TELEVISION NEWS**



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Norway—Radio Norway informed Osterman, N. Y., that sign-on melody is produced by an electric music box, has no name, and is from an old folk tune. Sends nice card with Norwegian flag on one side, data on other side.

Oslo now has its letter program and musical requests on Saturdays 1400-1500 on 9.645, 15.170, 17.825, 21.730; LLG is now heard on 9.645 instead of previous 9.610. (Pearce, England.) LLN, 17.825, is good signal in Pennsylvania 1315. (Kane, Pa.)

Radio Norway currently is using LKV, 15.170; LLP, 21.670; LKQ, 11.735; LLN, 17.825; LLG, 9.645, and LLK, 11.850. At 2000-2100 LKV, LKQ, LLG are beamed to North American Waters and North Atlantic; at 0600-0645 weekdays, LLP, LLN, LKV, and LLK beam to African Waters and South Atlantic; at 0800-0830 LLP, LLN, LKV, LLG beam to Indian Ocean; at 1400-1500 LLP, LLN, LKV, LLG beam to African Waters and South Atlantic, and at 1800-1900 LKV, LKQ, LLG beam to South America. These transmissions are in Norwegian and consist of home news and music; however, announcements also are made in English. (Swedish DX broadcast)

Every Tuesday and Friday, Radio Norway has a program in the "samic" language; there are some people in Northern Norway—"up against the Midnight Sun"—who speak this language. It is very interesting to listen to, reports Halvorsen, Oslo. The programs run 1015-1030 over the s.w. transmitter at Tromsø operating on 6.130 (10 kw.); also goes out over Tromsø 292 kc. and Finmark 347 kc.; announcement is "Dek lae Norge Rikaradio, Tromsast. Di labelet Samegiell programma." Translated it reads—"This is the Norwegian State Broadcasting, Tromsø. You hear a program in Samic." Address for reports is Radio Norway, Tromsø, Norway.

Outer Mongolia—Ulan-Bater, 5.265, is being heard in California mornings. (Dilg.) Is listed 15 kw.

Pakistan—Indian correspondents have informed Radio Australia that the new 50 kw. transmitter at Karachi has been operating on 11.885 for some weeks now. Daily schedule is 2030-2245, 0110-0130, 0200-0330, 0700-0720, 0730-0740, 0800-0810, 0830-0915 (External Service in Burmese), 1015-1045, 1045-1130 (Persian), 1135-1140, 1200-1240 (Afghan-Persian), 1245-1330 (Arabic), and a further program in Arabic is radiated from 1400. News is scheduled 2100, 0110, 0210, 0700, 0945, 1135. With the exception of the 0210 newscast, all these are relayed by Dacca on 15.335. Karachi announces Dacca's channel for 15.27; however, this is incorrect as Dacca long since moved to 15.335. Karachi has Western music 0300-0330. For some time I have been hearing the 11.885 Karachi outlet here in West Virginia with fair to excellent level at 0700 and again at 2100 during English newscasts "relayed from the Home Service of Radio Pakistan." Announces Karachi channel as 11.880 but it is higher, usually being slightly above

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40/20/20 — 150V-25V.....	44c
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Moscow's 11.88 (which at times does QRM Karachi).

Dacca, 15.335, is audible at 0700 some mornings but usually has bad QRM. It comes in extremely well in South Africa at 1000-1100 according to Ridgeway.

The Karachi outlet on 11.885 is good level in New York 0700 with news. (Osterman)

Panama—HORT, 6.060, "Radio Balboa," Panama City, identifies at 2115. (Leinbach, N. Y.)

Peru—OAX4Z, 5.894, Radio Nacional de Peru, Lima, noted 2030, readable but suffers from severe CWQRM; no English noted. OAX4V, 5.970, Radio America, La Voz del Nuevo Mundo, Lima, heard from 2330 to 0200; no English noted; stated that OAX4W, 9.375, was in parallel. (Novomestky, Puerto Rico)

Philippines—"Voice of America" relay schedules list Manila I, 11.89, 0400-0915 to Far East, 1700-1900 to China; Manila II, 15.250, 1700-1900 to East Asia; Manila III, 15.330, 0215-0345 (Tue.-Sat.) to S. E. Asia (UN), 0400-0915 to East Asia; Manila III, 17.760, 0400-0915 to E. Asia.

Simpson, Australia, received a letter-verification signed by the president of the Far Eastern Broadcasting Company, Inc., John C. Broger, for report on the new Manila station DZH6, 6.030. Mr. Broger said that verification cards are not at hand as yet, and that Simpson's was the first report received from anyone—but was followed within 30 minutes by one from a California listener! DZH6 is using "about 1 kw." with a half-wave dipole antenna about 50 feet above ground. DZH6 is currently operating on 6.030; DZH7 was to be using 9.730 around the middle of October; DZH8 should be on the air on 11.855 around the first of November, and DZH9 in the 19-m. band (15-megacycle range) should take to the ether around the middle of November. Heard by Simpson from around 0500. (Radio Australia.) This is a new missionary broadcaster—similar to HCJB, Quito, Ecuador; operates 0500-0900 daily and 2000-2300 Sundays; opens with "Oh, Hear the Power of Jesus' Name" (may mean "All Hail the Power of Jesus' Name"?), then news to 0515; music to 0530, then missionary broadcast; signal good in New Zealand to 0600, then has interference from HP5B, Panama. (Cushen)

DZH4, 6.000, heard 0645 with news and music; DZH3, approximately 9.500, heard 0400 with musical program and local news; DUH5, 11.84, heard 0615 with news and music; DZH6, 6.030, heard 0500 with news and music. (Sanderson, Australia)

Portugal—CS2WI, 12.864, Parede, heard with good signal 1645; at times plays recordings in English. (Oskay, N. J., via NNRC) CS2MA, 6.374, Lisbon, identifies 1930, excellent signal in New York. (Leinbach)

Portuguese Guinea—CQM-4, 6.993, Bissau, heard recently with weak signal 1724 to 1759 sign-off. (Ferguson, N. C.)

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**Portuguese India**—Radio Goa has moved from 7.230 to 9.610; is on daily now 0730-1030 and on Sundays there is a further transmission 0100-0230 (this one in *English*) when announces, "This is Radio Goa, the Voice of Goa, the Voice of Portugal"; the daily schedule is rather complicated by languages but the station appears to use Concuri, Portuguese, Urdu, Marathi, and Hindustani. When closing 1030 always goes off the air following the playing of the Portuguese National Anthem ("A Portuguesa"). (*Radio Australia*.) To my knowledge, up to the time this was compiled, Radio Goa had not been heard in America.

**Roumania**—Radio Bucharest, 9.25, heard with fair level in South Africa with news 1500. (*Ridgeway*.) Is also carried on channels of 5.950, 6.210, 11.900. (Swedish DX broadcast)

**South Africa**—Ridgeway, South Africa, writes—"ZRB is a government-owned transmitter at Roberts Heights, near Pretoria; this is a South African Air Force Station whose main function is to give weather reports and other meteorological data on the hour (although I believe not necessarily every hour). The schedule appears daily except Sundays and Wednesdays from 0000 to 1100 on 9.110, 6.210. There is no transmission on Sundays, and on Wednesdays it leaves the air around 0600. When not giving weather reports for the use of aircraft, ZRB relays programs from the Johannesburg transmitters—which are divided into two classes, an "A" and a "B" program carrying *English* and Afrikaans programs, respectively. ZRB takes relays from either of these programs just as it chooses. It is, therefore, quite probable that you will get *English* or Afrikaans news at 0000—sometimes Afrikaans for a few days running, and sometimes *English*. It relays news in *English* from the BBC at 0100 as do all SABC transmitters. ZRB and Cape Town have no connection whatsoever."

ZUD-24 verified for Jack Fox, N. Z., stating transmitter is a 7 kw. job; also said is on fixed service at 0045 on 13.186; however, this transmission was logged by Fox and by Bluman, Israel, on 17.745; the 8.695 channel has been good in New Zealand at 1045-1125 on Saturdays; according to the letter, this Robert Heights location was to be changed as well as name of the station. (*Radio Australia*.) This one is used primarily for relays.

**Southern Rhodesia**—Gpod, England, has heard test transmissions from Salisbury, 3.320, to 1500; asked for reports. (Swedish DX broadcast)

**Spain**—Widely reported is Madrid's daily transmission 1800-1830 (in *English*) to the United States on 9.369; now announces as "The National Broadcaster in Madrid, Spain." (Worris, N. Y.) This is the first time Madrid has used an *English* equivalent for Radio Nacional de Espana, comments Worris.

**Sweden**—Radio Sweden now broadcasts in *English* for scouts on the first

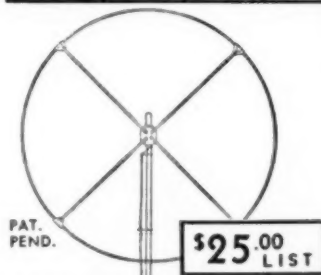
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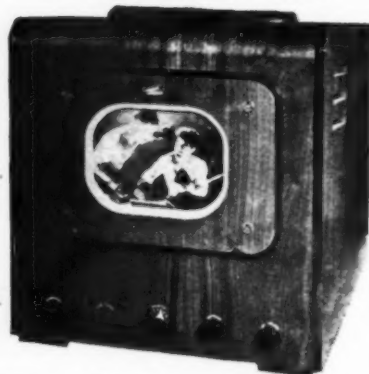
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The weekly DX session on Saturdays is carried 0215 on 6.065, 15.155; rebroadcast 1015 and 2015 on 10.78, 15.155. Correspondence concerning the programs is welcomed by the DX Editor (Arne Skoog), *Radio Sweden*, Stockholm 7, Sweden.

A special presentation of Swedish music and Swedish artists is now being broadcast on Thursdays 1910 by *Radio Sweden* on 10.78, 15.155. (Swedish DX broadcast)

**Tahiti**—*Radio Tahiti*, officially given as 12.080, was measured in West Virginia as 12.080.2. (Arthur.) Measured by Gross, Washington State, as 12.082, and by Huse, same state, three nights in a row, as on 12.080. Ferguson, N. C., measured it 12.081; and Simpson, Australia, measured it 12.082, according to *Radio Australia*. Announces wavelength of 24.83 metres (which converts to 12.087).

**Thailand**—HS8PD, 6.010, good signal with news 0615. (Sanderson, Australia.) The 11.65 outlet should be in parallel, and one or both should have a further (native) transmission beginning 0700.

**Trinidad**—*Radio Trinidad*, 9.625, Port-of-Spain, noted with good signal 0530 and 2130 to closedown 2200; sometimes is like a "local" in New York mornings. (Osterman) Is excellent here in West Virginia 0600 with BBC news relay.

**Turkey**—TAQ, 15.195, Ankara, states English program 1530-1600 is now radiated to Britain on Thursdays only; has dropped temporarily the similar broadcast on Mondays; news continues daily at 1345 over TAP, 9.465, and Postbag remains at 1530-1600 on Sundays over TAQ. (Pearce, England)

**Uruguay**—Verification from CXA10, 11.900, Montevideo, lists these outlets—On medium-wave, CX6, 650 kcs., CX38, 1290 kcs.; on short-wave, CXA4, 6.125, CXA10, 11.900, Transmitter "A," 20 kw.; CXA6, 9.650, CXA18, 15.300, Transmitter "B," 5 kw. These are *Radio Electrica* outlets and QRA is Servicio Oficial de Difusion Radio Electrica, Andes 1465, Montevideo, Republic of Uruguay. (Osterman, N. Y.)

**U. S. A.**—Fried, Mich., has received word from Associated Broadcasters, Inc., West Coast, that the signal he heard on 11.94 and which he thought might be a Far Eastern relay of KWIX-KWID is a result of the beat frequency between the two transmitters being cross modulated, to produce a new frequency on 11.94 (the stations actually operate on 11.86 and 11.90). The two transmitters are in the same building and r.f. from one rig does get into the other, the official stated. "We had a similar condition previously when operating on 9.57 and 11.86. The 40 kc. separation makes it impossible to filter one transmitter frequency from getting into the other without affecting the transmitted signal. Sta-

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1S5	6AC5	6C4	6S8	6X5	12S8	32L7	46	82
1T4	6AG5	6C6	6SA7	12A8	12SA7GT	35	47	84
1T5	6AK5	6D6	6SD7	12A15	12SF5	35B5	50B5	85
1U4	6AL5	6F5GT	6SF5	12AT6	12SJ7	35C5	50C5	117Z3
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The format of the new "Voice of America" schedule booklets has been radically altered. They now are attractive magazines with full-color illustrations on the covers and show great improvement in technical details of transmission schedules. The "Voice" is now distributing a *Worldwide English Edition* which contains complete schedules of *English* and *non-English* programs. This is in addition to the former eight other editions. (Worris, N. Y.)

U. S. S. R.—Moscow, 15.14, is good, and 15.34, in parallel, is fair during the *English* program to Asia 0700-0800.

Vatican—HVJ, 11.740, heard well in *English* 1000 and 1315; at 1000 uses 15.095 and approximately 9.64 in parallel, and at 1315 is parallel with approximately 9.64 and 5.970. (Pearce, England)

Western Samoa—ZM2AP, Apia, formerly ZMB6, 7.700, verified by card; no longer operates on s.w. but is on 420 kc. with 2 kw. (Legge, N. Y.)

Yugoslavia—Radio Belgrade, 9.505, heard with Spanish around 0100 and news in *English* 0115-0130; announces next *English* for 1115 on 49.18 m. (6.140?). (Pearce, England) Noted in French from 2345 to 2400 sign-off, woman gave news in French. (Bellington, N. Y.) Is listed 10 kw. Heard by Osterman, N. Y., 0115 to closedown 0130 with news in *English* read by woman; almost buried in QRM from BBC's 9.51 outlet; confirms Pearce's report announcing next *English* for 1115; slogan seems to be "Radio Belgrad, 'The Voice of the People!'"

The 9.505 channel heard in Texas 0000-0015 in foreign language, woman announcer. (Stark)

#### Last Minute Tips

At the time this was compiled, I was finding Asiatic DX beginning to open up well here in the East. Several mornings I had been hearing Nanking, 5.985, 9.73; Peiping, 10.260, with good signals around 0500-0700. *Radio Malaya*, 6.025, Kuala Lumpur, was being heard with news and market reports 0630, and Bangkok, 6.010, was heard one Sunday with excellent quality and level during the daily 0615 newscast, signs off 0630.

Hong Kong's ZBW-3, 9.525, is heard 0430; good, clear signal in Australia. (Sanderson) Should carry BBC news relay 0600.

*Radio Espana Independiente* has been heard in Sweden on a new channel of approximately 15.850, afternoons (EST). (Carlberg, Sweden)

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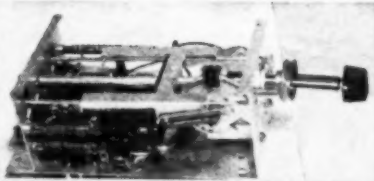
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- Can be used with EICO Model 400K or any other standard oscilloscope.
- All components furnished, including lifelong etched panel and durable steel cabinet.
- Comes complete with all tubes (including new high frequency miniature type); 6X5GT, 12AU7, and 2-6C4. Crystals not included.

SIZE: 10" x 8" x 6 1/4"

Kit Form.....\$29.95

Factory Wired Form.....\$39.95

All FM and TV Channels marked directly on the panel for easy reference.

### Aeradio Miniature Aircraft Transmitters-Receiver

#### Transmitter—Model TRA

Uses three type 14C5 tubes. Crystal controlled for frequencies 3105 and 6210. Built-in Power Supply for operation from storage battery.

#### Receiver—5-tube—Highly Sensitive

Two Bands—Broadcast (600-1500 KC) and 200-400 KC.

Has built-in 1000-cycle Range Filter with On-Off Switch, Volume Control, Bandswitch and Transmitter On-Off Switch.

These units are sold as-is, some requiring minor repairs—less connecting cable.

Price, per Pair.....\$13.75

### IRC—Shallcross Precision Resistors

#### Types WW3, WW4, WW5

Following sizes are \$0.35 each: \$27.50 100: 800,000 1% 600,000 1% 125,000 1% 700,000 1% 220,000 2% 120,000 1%

Following sizes are \$0.25 each: \$19.50 100 most sizes are 1% or better—others 2%: 95,000 20,000 7,500 1,400 70 92,000 17,000 5,000 1,200 50 84,000 15,000 4,500 1,000 30 82,000 12,000 4,300 750 22 80,000 11,000 4,000 140 20 66,000 10,000 2,200 130 14 46,000 8,000 1,500 125 12 33,000

Following sizes are \$0.15 each: \$12.50 100 odd types are 1% or better, round numbers are 3% or better: .399 meg. 26,500 2,230 235 40 .268 meg. 22,000 1,123 110 35 109,000 20,870 988 70 30 54,500 17,300 280 50 6 50,000

Following sizes are \$0.10 each: \$8.50 100 most sizes are 1% or better: 414.3 53.96 13.333 3.94 1.563 366.6 53.32 10.2 3.5 .29 220.4 33.22 5.1 2.56 .256 147.5 23.25 4.3 2.14 .25 105.8 13.52

### RADIOSONDE (Weather) Transmitter AN/AMQ-1D

Includes following: 1—Miniature Battery Transmitter complete with 3A5 tube—operates on 72 mc approx.; 1—Miniature sensitive relay SPDT with 100 ohm coil; 1—Temperature-sensitive resistance element; 1—1 unitidity sensitive strip; 1—Pressure, temperature, humidity chart, the entire unit is encased in the original packing and is brand new.

Price.....\$3.95

Write for Latest Catalog R11 Listing Thousands of Relays, Resistors, Condensers, Switches, etc.

**EDLIE ELECTRONICS, INC.**

Telephone Digby 9-3143  
154 Greenwich Street New York 6, N. Y.

Austria, noted 1420-1450 with popular recordings. (Nordh, Sweden)

For the benefit of SWL's outside the USA, the "Voice of America" is now QSL'd by regular-size card; it has blue and red background with white letters, very attractive. (Hubbard, N. C.)

A station heard in Australia on 4.495 from 0500 to 0980 or later may be Korea. (Hutchins, Radio Australia)

Radio Saigon, 11.78, will broadcast a special DX program for the Swedish DX Fan Club, England-Sweden, on December 13. (Good, England) Time had not been learned when compiling this copy, but the broadcast most likely will be carried around 0500 EST (1000 GMT) and it is possible that 6.165 also will be used. Definite time and other details will be given well in advance in the DX session from Radio Sweden and probably also in the DX program from Radio Australia.

Some weeks ago, the Liner *Italia*, about 1,600 miles northeast of New York, was heard passing tickets to Rome for wireless-telephone calls; heard on 17.00 at 1240-1254. (McPheeters, N. Y.)

Balbi, Calif., reports as new a station on approximately 6.020 with sign-on around 0630; all-Chinese talk to 0710 sign-off; no music or any particular announcement at either sign-on or sign-off; man sounds like a Russian; signal strong, modulation poor; Balbi is fairly certain this is a U. S. S. R. outlet.

An unidentified station has been heard on 4.450 in Sweden carrying BBC programs around 0800; may be a BBC relay station in the Far East? (Carlberg)

Direct via airmail from Halvorsen, Oslo, Norway, comes this word—"In the near future—I suppose in October or November—the college men in Trondheim will have their special week, *Studenteruka-49*. During the week they will have a transmitter in operation. I cannot yet tell you the frequency they will use, but in 1948 it was in the 41-meter band. They issue a nice, amusing QSL card."

Here are tips received at press time from Dilg, California—Shanghai was heard for a few days on approximately 11.685 mornings, but not more recently, so may have moved up to (former) 11.860 region. India heard opening up strong 1100 on 15.160, announced program would be in Hindustani. North Korea has moved from 4.400 to around 4.500; is in dual with 7.785 mornings. Nanking, 5.985, takes Peiping (North China) program at times—but does not carry the *English* at 0830. Peiping now announces frequencies of 9.730 (Nanking), and others, but no longer lists the station on 6.096; they do not mention the 9.740 Hankow outlet although that one does take the *English* program from Peiping at 0830; the 9.740 station is in dual with Peiping only part of the time and one day at the close of the *English* relay from Peiping (which ends 0850), the Hankow station played some old American records (including "Red Wing"). An In-

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ROY H. BROWNING, Director

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## RADIO & TELEVISION NEWS



doneasian heard mornings on approximately 5.060 may be Makassar, Celebes, but is not in dual with the 9.550 Makassar outlet. Bandoeng was heard recently on about 10.070 one morning and what may be Bandoeng was heard also on 11.600 around 0800. Mukden, Manchuria, is still using approximately 5.525 and has a good signal; relays portions of Peiping's New China programs but does not take the English period 0830.

Leven, Brazil, airmails that *Radio Nacional*, Rio de Janeiro, is now transmitting on a new channel of 6.147 at 1130-1500, using the call PRL-9 (formerly—or still?—assigned to the 17.85 outlet). *Radio Tamoio*, Rio de Janeiro, is on 9.61 with ZYC8, scheduled 0500-2200 daily, and now is permanently in parallel with m.w. outlet PRB-7, while ZYC9, 15.37, is now parallel all day with m.w. PRC-3, *Radio Tupi*, Rio de Janeiro. *Radio Ministerio da Educacao*, Rio de Janeiro, continues with PRL-4 on a "most unfortunate" frequency of 9.767—the same as OTC-2, Belgian Congo. Leven says "mutual" QRM is terrific. PRL-4 is given with 1 kw. power and is scheduled the same as m.w. PRA-2, 800 kcs.—weekdays 0500-1200, 1300-1400, 1500-2130, Sundays 0800-2130. This is a government-owned station and therefore makes no commercial announcements, a fact highly appreciated at least by the Rio audience because s.w. shouldn't be reaching very many people outside Rio, Leven comments. Programs are of a high cultural nature and standard, and Rio papers always are full of praise for them. Leven comments that it is really most regrettable that s.w. transmissions from this outlet are not coming outside Brazil better. Sao Paulo's ZYB-8, 11.765, is transmitting a daily program in Spanish starting at 1200 with news and commentaries about life in Brazil.

Finally, Bellington, N. Y., flashed at press time that *Kol-Yisrael*, Tel-Aviv, Israel, has been moving around, perhaps testing its new 7.5 kw. transmitter. Has been heard around 1500 to 1515-1530 sign-off, very strong signal on approximately 11.94. Also has been heard on same channel at 2245 opening, with 6.83, and Haifi, 8.17, both weak, in parallel; later was heard back on 9.000 and not on 11.94—but more recently it was heard opening 2245 on about 12.09 to 12.10 with "tremendous" signal compared to reception on other channels it has used. May be testing preparatory to starting the projected beam to North America (to be in English in addition to Hebrew). I hope to have further details on current operations of *Kol-Yisrael* next month.

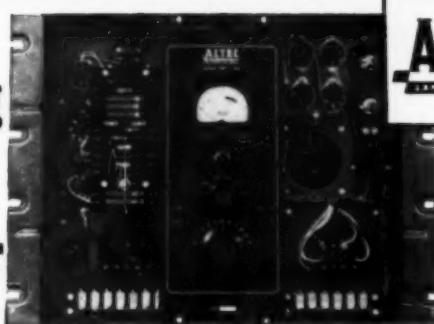
#### Acknowledgment

As the 1949 winter DX season gets under way, reports are beginning to increase. Many thanks, fellows, and keep them coming to 943 Stewartstown Road, Morgantown, West Virginia, U. S. A. New monitors for the *ISW Department* are always welcomed from anywhere in the world. . . . K.R.B.

November, 1949

## IN THE PROFESSION, AN HONORED NAME

### the Altec Lansing A-256A amplifier



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### WILL MEET YOUR REQUIREMENTS FOR AUDIO POWER

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The A-256A Amplifier is assembled on a relay rack of recess pan construction, making it adaptable to either rack or cabinet mounting. Sound design and the use of conservatively rated quality com-

ponents insure the user of long trouble-free life without deterioration in performance characteristics.

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GAIN: 50 DB, 500 ohm input.

FREQUENCY RANGE: 20-20,000 cycles within 1/2 DB.

NOISE LEVEL: -45 dbm (.001 watt reference).

OUTPUT IMPEDANCE: Taps for 8 & 16 ohm loads.

INPUT IMPEDANCE: 30, 250 & 500 ohms.  
5,000 ohm bridging input.

For technical bulletin, write

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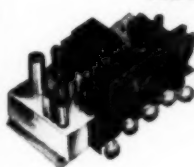


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3-6 mes. Receiver and a 4-5.3 mes. or 5.3-7 mes. Transmitter, less top cover. Used, good cond. With all tubes and crystal.  
Per Set. **\$6.50**

**SCR 515/BC 645 TRANSCEIVER:** Ready for citizens' band with slight modification. Comes complete with following: transceiver unit, control box, dynamotor, rack, all plugs and antennas. Brand new.  
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**BC-603 RECEIVER:** 10-channel, push-button or manual tuning, through a freq. range of 20-28 mcs. Squeal adjustable to cut in at 5 microvolts. FM 100 kes. wide. Can be converted to AM operation by by-passing lim. and disc. FM either 100 or 20 kes. wide. Operates from 12 or 24 V. Used, excel. cond.  
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**BC-683 RECEIVER:** Same circuit as above, except higher freq. range of 28 to 39 mes. Hot on 10 meters. Complete with dynamotor. New. **\$21.50**  
Less dynamotor **\$18.50**

**BC-924-A XMITTER:** Operates from 12 to 24 VDC. Has 815 doubler and 815 final, 4-channel VFO tuning through a range of 27 to 39 mes. 2 buffer stages between oscillator and doubler stages. Just the rig for 10 meters. Electrically perfect.  
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**ARN-7 ADF COMPASS:** Covers from 100 to 1,750 kes. Ideal for hi-fi broadcast tuner or receiver.  
Excellent condition. **\$15.95**

**PE-55 DYNAMOTOR:** Output of 500 V. at 200 mls continuous or 400 mls intermittent. Brand new in orig. carton. **\$9.95**

**RGEU COAX CABLE:** 52 ohms. New. **5¢**  
Per ft. **\$4.75**  
Per 100 ft.

**2 V-WILLARD WET CELL BATTERIES:** No. 20-2. Brand new. Individually boxed. Each. **87¢**  
Order 2 for only **\$1.69**

**For More Dope on Following Items See Our Ad Sept. 1949 Radio News Page 143**

Racks: Double **\$1.00** Triple **\$1.39**  
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Fets: 5,000, 20,000, 250,000 ohms. 15 for **1.50**  
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1 OR TUBE PRICES see ad P. 100 Aug.-1949  
RADIO NEWS

**CE-1 SPEAKER:** Similar to LS-7 Army speaker. 4.5 x 4.5 x 3 in. With clamp for mounting. Has 5-ft. cord with PL-55. Ready for use with high or low imp. transformer.  
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## Servicing P.A. Systems

(Continued from page 71)

per-cent or more below normal should be replaced, since the oxide or other emitting element usually deteriorates rapidly from this point. Tests for shorts and leakage should be made according to instructions with the individual tube tester. The most common point of leakage, both constant and intermittent, is from heater to cathode. This very often is the cause of distortion in beam power tubes.

Intermittent operation can be checked by tapping the tube envelope with the fingers or with a small rubber mallet. Tube noise and microphonics may best be determined by this method, with the tubes in the amplifier. Often a short will appear momentarily and then disappear when tapped or when the operating temperature increases. Tubes showing this indication may be responsible for later trouble and a "comeback." Any tube which appears abnormal, even momentarily, should be replaced as a safe measure.

## Voltages

All voltage tests should be made with the amplifier in normal operation or as near normal as possible, with all tubes in their sockets. Point-to-point measurements should be made, starting at the tube sockets. For practical purposes, an ordinary 1000 ohms-per-volt meter will serve for plate, screen, and cathode voltage readings. For a.v.c., limiter, inverter, and other critical circuits, however, a vacuum-tube volt-meter must be used.

## Resistors

These should be checked for thermal noise, open circuit, and overheating. Carbon resistors sometimes develop high internal noise; wirewound units may short between adjacent turns or become open due to heat expansion. The cause of overheating should be found as quickly as possible. In most cases it is desirable to turn the ampli-

fier off and check for component shorts with an ohmmeter. Resistors with values exceeding the usual ten or twenty per-cent tolerance should be replaced.

## Condensers

Electrolytic and paper condensers may be checked with an ohmmeter, condenser bridge, or by the substitution method. The ohmmeter is preferred for locating shorted condensers. For complete tests, the condenser analyzer is recommended. The usual bridge is reasonably priced, simple to operate, and saves time otherwise spent in substitution tests. A simultaneous check can be made for capacity, leakage, intermittents, opens, shorts, and power factor in electrolytics. For accurate tests it is necessary to disconnect only one lead of the condenser to be tested.

Condensers should be checked for noise and intermittents while in the circuit by tapping, probing, or vibrating gently, and should be inspected for open or dried-out containers and evidences of overheating. Coupling condensers and a.v.c. circuits are especially noted for leakage. In replacing these units, be sure to use only the best replacements available.

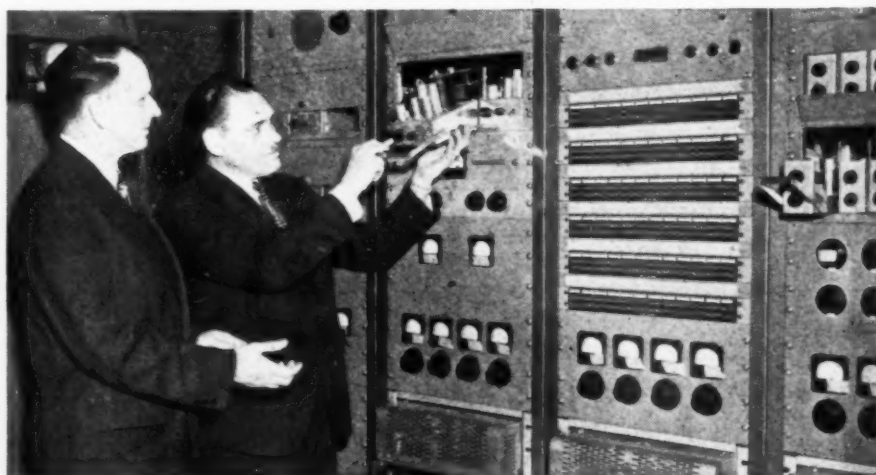
## Interstage and Output Transformers

Windings should be checked with an ohmmeter for opens and shorts. Primary and secondary windings seldom short to each other but often a section of one winding will become shorted internally. Halves of push-pull windings should be checked for balanced readings and replaced if the ohmic values are not reasonably close together. Transformers should be examined for overheating and loose core laminations.

## Gain Controls

These seldom give trouble outside of becoming noisy and worn. A noisy control can sometimes be cleaned by removing the back cover, flushing with carbon tetrachloride, and applying a thin film of vaseline to the moving parts. If the control is worn or

RCA's high-level sound system in Philadelphia's Convention Hall.





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**THE ORIGINAL  
CONICAL TV ANTENNA**  
Single Stack, Model 2X complete, Only **\$7.50**  
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Operates 10"-12"-16" Picture Tube. ONLY **\$169.95**

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CLOSEOUT!**  
**BAUSCH & LOMB**  
F1.9 PROJECTION  
TV LENS

F1.9 EF.5 in. (127.0 mm). For use with Type STP-4 Tube. Lens will project suitable pictures up to 6x9 feet. Reg. \$125.00.

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extremely noisy, replacement obviously is the only solution. Variable controls in the grid circuit usually are between 250,000 ohms and 1 megohm. Values differing radically, unless in cathode bias or special circuits, usually indicate defects or tampering and should be corrected. If in doubt consult the manufacturer's notes or the circuit diagram.

Leads to controls should be kept well away from a.c. and filament leads and shielded to reduce hum pickup from these sources.

#### Microphones

Crystal microphone troubles usually are limited to de-activated crystals, open cable leads, or paralysis due to rough treatment. Dynamic microphones may have "frozen" or warped diaphragms caused by dropping or rough handling, de-magnetized fields from operating too near high-level a.c. fields, and occasional coupling transformer troubles. Velocity microphones seldom are used in rugged p.a. installations, due to the tendency of ribbons to stick, sag, or "pop," especially in windy or open-air installations.

#### Tube Sockets, Terminals

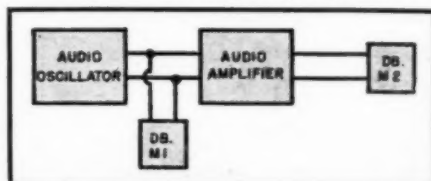
Sockets should be checked for loose prongs, dirty contacts, and evidences of arcing between prongs (especially the rectifier socket). Soldered connections should be examined for high-resistance or cold-soldered joints; wiring should be inspected for breaks and worn insulation; and all a.c. and filament leads must be routed as far away from low-level circuits as possible.

#### Quality Test, Frequency Response Measurements

After the entire amplifier has been serviced, a final test should be made to determine over-all operating efficiency and frequency response. An audio oscillator (see Fig. 1), with a db. meter or low-range a.c. voltmeter across its output, is connected to the amplifier input. An output meter is connected across the amplifier output transformer, preferably from plate-to-plate. With the gain controls set at normal, the audio oscillator is varied from about 30 cycles to 10,000 cycles and its output level adjusted, if necessary, to maintain a constant reading on the first meter. The amount by which the second meter (at the amplifier output) varies indicates the frequency response of the amplifier system. A typical high-fidelity amplifier will be "flat" to within plus or minus 2 db. over the entire range.

-30-

Fig. 1. Standard setup for measuring amplifier frequency response.



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**TELEVISION  
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#### Featuring:

- NEW DESIGN
- BETTER — STRONGER
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- 30' ALL TOWER — NOT A MAST

Here's a new triangular TV tower that really meets the requirements of the most exacting Radio Serviceman. It sets a new high — has tremendous strength because of its new type construction — and is easy to erect.

#### Lighter Weight Greater Strength

Completely new in design, it has uprights of hard drawn tubular steel—offering greatest possible strength to weight ratio. Weight of the basic 30' tower is a mere 62 lbs. Base is 19" center to center triangle, tapering to 4" at the top. Top has hole for 2" mast. It's easy to erect, coming in 10 foot sections. Additional extensions available to provide any height up to 100 feet. Extensions are quickly added by bolting above the first 10-foot section. Tower has hinged feet for bolting to peaked or level roof.

#### Withstands Icing-Winds

The tower will easily carry any TV or FM antenna, directional array and rotator.

#### Durably Finished

It's durably finished with two coats of aluminum enamel.

#### LOW-LOW PRICE

30' GC Tower No. 8352RN.....List **\$79.50**

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**ALL GC Products Are Fully Protected  
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**DIAMOND STYLI**  
maintain a polished, rounded tip which  
minimizes wear on record grooves  
AFTER 1000 PLAYS ON STANDARD-GROOVE RECORDS



AFTER ONLY 15 PLAYS ON MICRO-GROOVE RECORDS



The above photomicrographs (greatly enlarged) show the results of wear on stylus tips. Note the smooth, round, unchanged contours on the diamond styli. Compare them with the sharp chisel points worn on the sapphire and osmium tips. These sharp edges cut groove walls and destroy response.

**Scientists find that diamond is  
90 TIMES MORE RESISTANT TO WEAR  
AND 4-10 TIMES STRONGER  
than sapphire—the next hardest material**

Why subject the records you treasure to the ruinous grinding action of worn styli? You can preserve your collection—and save money too—by using a diamond stylus. It would cost at least \$100 in sapphire stylus replacements to equal the durability and efficiency of one diamond stylus.

## SPECIAL OFFER SAVES YOU MONEY

Remember that in many cases a stylus becomes worn—and causes damage—long before the defect is audible. It is far cheaper to replace your present stylus with a diamond than to have to replace or bear the loss of fine records. And you can now obtain a genuine diamond stylus—for standard or micro-groove records—at the **LOWEST PRICE EVER OFFERED!**

These are the finest styli available.  
The same styli are used by radio stations.

**REPLACEMENTS CAN BE MADE ON  
NEARLY EVERY TYPE OF CARTRIDGE**

**ATTENTION G. E. CARTRIDGE OWNERS:** Don't throw away your old model variable reluctance cartridge. The worn stylus can be replaced with diamond by our experts.

Here's how to get your diamond stylus replacement, which will pay for itself over and over. Just fill out the coupon below and mail it today. We will send you a special mailer in which you mail your cartridge or stylus assembly to us; we will replace with a new diamond stylus and return to you within a few days. If not completely satisfied after a 10 day trial, your money will be refunded.

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Enclosed is ☐ check ☐ money order for \$14.95 for one diamond stylus replacement.

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#### ERRATUM

In the September issue, on Page 68, the director length given in Table 1 for Channel 7 should read 2'6 3/4" instead of 4'6 3/4".

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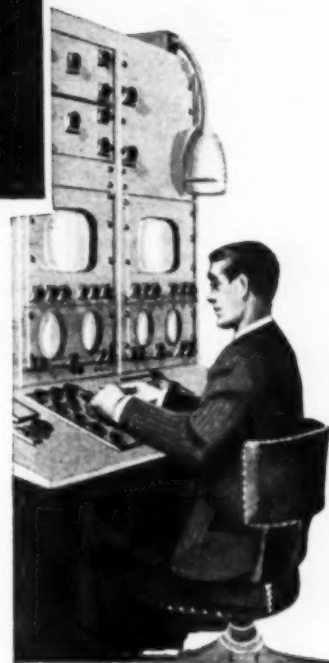
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## BARGAINS

Howard FM Tuners model No. 482	\$28.95
McMurdo Silver model No. 904	
Cond. Bridge	35.00
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### HAUSFELD RADIO SUPPLY

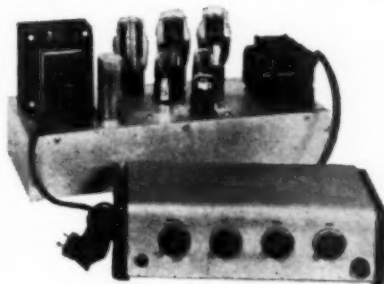
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## For the HIGHEST QUALITY

## in TONAL REPRODUCTION

The Connoisseur of Music Listening wants to recognize delicate shadings of Symphonic sound — and anything but the real thing is a source of annoyance — that is until the

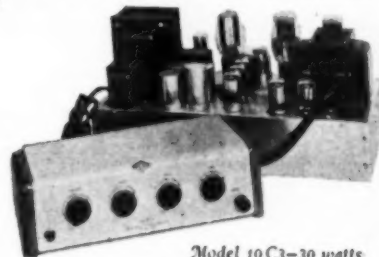
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### FOR BEST RESULTS — BROOK GIVES

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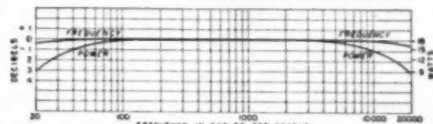


## AUDIO DESIGN ENGINEERS!

In amplifier design, the weakest link in the chain may now be your strongest! Often the difference between a good amplifier and a mediocre amplifier lies with the output transformer. Peerless 20-20 Line output transformers handle full rated power from 40 to 10,000 cycles within 1 db. Examine this typical curve for an 18-watt rated transformer which shows power output and frequency response. Because of careful design, feedback up to 25 db can be used with these transformers without experiencing appreciable difficulty from phase shift.



### PEERLESS 20-20 LINE OUTPUT TRANSFORMERS



Peerless guarantees that published characteristic curves are true, accurate, unretouched, made on production line items.

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## Portable TRI-TUBE Antenna MASTS

**TELEVISION FM • AMATEUR COMMERCIAL**

**LOW COST**  
• **LIGHT**  
• **QUICK**  
• **EASY**

Mast section is triangular in construction using 1" ID steel tubing with proper bracing, all electric welding. Lower unit is 20 ft. long hinged on frame with locking device. Levelling device compensates for position of vehicle on any test location. Upper unit is a smaller triangle and telescopes into lower unit on rollers, which allow smoother operation. Cable and drum provided with pin assembly for safety and locking into any height. Antenna mast can be set up by two men in a few moments. NO GUYS — NO WRENCHES — NO BOLTS. All bolts have 'T' handles. Demountable by removing two bolts in four minutes. Aluminum painted ready to mount.

- 250 BASIC UNIT COMPLETE 50 ft., 10 ft. pole
- 251 SAME AS 250-ORIENTATION AT ANY HEIGHT
- 252 SAME AS 251, WITH ANTENNA HEIGHT 70 FEET

## A. A. PETERS TRI-TUBE MASTS

231 N. 7th Allentown Pa.

SHIPPED F.O.B. ALLENTOWN, PA.

\$295 and up





## Components by the Thousands!

## TOGGLE AND PUSH SWITCHES



FIG. A FIG. B FIG. C FIG. D FIG. E FIG. F FIG. G FIG. H FIG. I FIG. J FIG. K FIG. L FIG. M FIG. N

STOCK NUMBER	FIG.	CONTACT	CONTACT ARRANGEMENT	MANUFACTURER & NUMBER	TYPE LEVER	MOUNTING DATA	UNIT PRICE
370-1 A	5a	125P	SPST MOMENTARY	CH B-3022-08	RAT C	1-12/16 WTC, C	\$0.30
370-4 A	5a	125P	SPST CENTER OFF	CH B-94	RAT C	1-12/16 WTC, C	.35
370-14 A	5a	125P	SPST CEN. OFF 1 SIDE MOM.	CH B-7A	RAT C	1-12/16 WTC, C	.35
17-108 A	5a	125P	SPST CENTER OFF	CH B-80	RAT C	1-13/16 WTC, C	.28
17-102 A	5a	125P	SPST CENTER OFF	CH B-3022-18	RAT C	1-12/16 WTC, C	.28
17-103 A	5a	125P	SPST MOMENTARY	CH B-15123	RAT C	1-12/16 WTC, C	.28
17-104 A	20a	24V	SPST 1 SIDE MOMENTARY	CH B-5A	RAT C	1-12/16 WTC, C	.28
17-100 B	5a	125P	SPST MOMENTARY	CH B0050500	RAT C	1-12/16 WTC, C	.35
300-100 C	20a	24V	SPST 1 SIDE MOMENTARY	CH B-3023-3	RAT C	1-12/16 WTC, C	.35
300-102 C	20a	24V	DPDT CEN. OFF MOMENTARY	CH C-11	RAT C	1-12/16 WTC, C	.45
300-102 C	20a	24V	DPDT MOMENTARY	CH C-1	RAT C	1-12/16 WTC, C	.45
370-31 C	5a	125P	DPDT	CH 67113	RAT C	1-13/16 WTC, C	.45
300-67 E	5a	125P	1 SIDE DPDT MOM 1 SIDE SPST	CH C-18	RAT C	1-12/16 WTC, C	.55
300-80 E	5a	125P	DPDT MOMENTARY	CH 66175	RAT C	7/16-32 BUSHING	.58
300-80 E	3a	125P	SPST CENTER OFF	CH B-3001-18	RAT C	7/16-32 BUSHING	.58
17-101 F	5a	125P	SPST CENTER OFF	CH B-1445	RAT C	7/16-32 BUSHING	.58
17-101 F	5a	125P	SPST MOMENTARY	ALAN W TEARD	BAITL	7/16-32 BUSHING	.58
301-61 G	5a	125P	4PDT MOMENTARY	CH 6005514	RAT C	1-12/16 WTC, C	.70
300-140 H	5a	125P	DPDT	CH 67145	RAT C	3/16-32 BUSHING	.85
300-140 H	3a	125P	DPDT NO MAKE EACH SIDE	OPEN FRAME	RAT C	3/16-32 BUSHING	.85
300-141 H	5a	125P	SPST	CH 67163	RAT C	1-12/16 WTC, C	1.25
300-141 H	3a	125P	DPDT	ALAN	BAITL	1-12/16 WTC, C	1.25
300-70 I	3a	125P	DPDT	ALAN OPEN FRAME	BAITL	3/4-4 WTC	.75
301-12 M	5a	250V	DPDT	ALAN SPECIAL POW. BAKET TALKER	RAT C	7/16-32 BUSHING	.75
300-70 I	3a	125P	DPDT	ALAN	BAITL	7/16-32 BUSHING	.75

§ INDICATES A LUMINESCENT TIP



FIG. A FIG. B FIG. C FIG. D FIG. E FIG. F FIG. G FIG. H FIG. I FIG. J FIG. K FIG. L FIG. M FIG. N

FIG. NO.	FIG.	CONTACTS	WELDING DATA	BUSHING LENGTH	REMARKS	ADDITIONAL INFORMATION	UNIT PRICE
301-20	A	N.O.	3/8-32 THD.	3/16	BLACK BAKELITE	USED ON SCW-300	\$0.15
303-08	A	SPST	3/8-32 THD.	3/16	BLACK BAKELITE		.25
303-75	B	3 MAKE	3/8-32 THD.	3/8	RED OR GREEN PLASTIC		.25
303-77	B	N.O.	3/8-32 THD.	3/8	BLACK BAKELITE		.25
305-163	B	DPOF	3/8-32 THD.	3/8	BLACK BAKELITE		.27
305-163	B	SPST	7/16-32 THD.	1/2	METAL		.12
370-13	C	N.O.	7/16-32 THD.	1/8	METAL - PLASTIC TIP		.25
IP-101	C	N.O.	7/16-32 THD.	1/16	METAL	GENERAL ELECTRIC	.25
IP-102	C	DPOF	7/16-32 THD.	1/2	METAL	GE	.25
IP-103	C	N.O.	7/16-32 THD.	1/2	METAL	FUTHER MANAGER	.25
IP-103	C	N.O.	7/16-32 THD.	1/2	BLACK BAKELITE	MADE 24-20 U	.60
303-106	F	1-17/16 MTC	1-17/16 MTC	1/2	METAL CAP	20-1000 CORD 20-180	.25
303-106	F	2 MAKE	5/8 WTC.	C	BLACK BAKELITE	20-1000 FOR 7-17 MTC	.35
370-9	F	N.O.	END OF CORD		BLACK BAKELITE	CH 2000000	.50
370-9	F	N.O.	END OF CORD		BLACK BAKELITE	SEAL CORD W/ 561-6	.50
370-28	F	N.O.	1-1/8 WTC		BLACK BAKELITE		.25
370-28	F	N.O.	1-1/8 WTC		BLACK BAKELITE		.25
303-99	A	N.O.	5/8 PRESS FIT		BLACK BAKELITE		.25
302-21	A	N.O.	3/4 PRESS FIT		WHITE PLASTIC		.25
301-40	I	N.C.	7/16-32 THD.	7/16	BLACK BAKELITE	3 SCREW TERMINALS	.25
302-99	I	N.C.	7/16-32 THD.	1/2	BLACK BAKELITE		.25
301-94	I	N.C.	5/8-28 THD.	1/4	BLACK BAKELITE		.25
370-37	M	N.O.	5/8-28 THD.	1/4	WHITE BAKELITE		.25
303-39	M	N.O.	5/8-28 THD.	1/4	BLACK BAKELITE		.15
370-39	M	SPST	5/8 PRESS FIT		CORRUGATED		.25
305-139	-	3 N.O. & 3 N.C.	15-32-32 THD.	1/2	3 BLACK BAKELITE	ASSEMBLY OF 3 SWITCHES	.80
370-40	-	N.O.	1-13/16 WTC.		3 CORRUPTED BAKELITE	WITH 3 CONDUCTOR CABLE	.80
370-40	-	N.O.	1-13/16 WTC.		METAL	SIMILAR TO MICRO SWITCH	.80

## Micro Switches

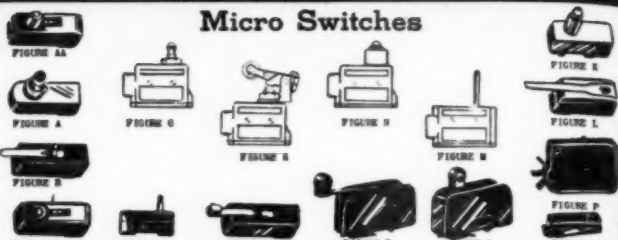


FIGURE C      FIGURE D      FIGURE E      FIGURE F      FIGURE G      FIGURE H

[illegible]

## SWITCHETTE



SPOT NO.	MEETING NUMBER'S TYPE NUMBER	CONTACTS	TELEPHONE LOCATION	IN P
303-20	CR1070C 100-3	N.C.	NITE	60.0
303-20	CR1070C 100-3	N.C.	FND	END
303-19	CR1070C 100-3	1-N.C., 1-N.C.	FND	END
303-18	CR1070C 100-3	1-N.C., 1-N.C.	NITE	END
303-19	CR1070C 100-3	N.C.	NITE	END
303-43	CR1070C 123-3	N.C.	FND	END
303-42	CR1070C 123-3	1-N.C., 1-N.C.	FND	END
303-43	CR1070C 123-3	SPOT	FND	END
303-22	CR1070C 123-4	SPOT	FND	END
303-21	CR1070C 126-4	SPOT	FND	END
303-19	CR1070C 126-3	1-N.C., 1-N.C.	NITE	END

## PRECISION AND POWER CONTROLS



QNC	DES	QMS	WAL	WAL	WAL	SHAFT	LOTH	WTR	GENERAL DESCRIPTION	PRICE
321-151	200	0	3"	6"				De Jux.	Water type, precision.	\$1.25
400-1	1000	1000	3"	3"				De Jux.	Water type, with mtg. bbb.	3.00
321-152	200	0	3"	6"				De Jux.	Water type, precision.	1.00
321-142	5	25	1-9/16"	SD Slot.				Omitte.	Type N lock type bushing.	0.04
321-143	5	25	1-9/16"	SD Slot.				Omitte.	Type N lock type bushing.	0.04
321-150	8	25	1-9/16"	"				Omitte.	Type N.	0.04
321-149	10	10	1-9/16"	"				Omitte.	Type N.	0.04
321-148	50	25	1-9/16"	SD Slot.				Omitte.	Type N lock type bushing.	0.04
321-147	50	25	1-9/16"	SD Slot.				Omitte.	Type N lock type bushing.	0.04
321-146	50	25	1-9/16"	SD Slot.				Omitte.	Type N lock type bushing.	0.04
321-145	75	15	7/16"	"				Omitte.	Type N.	0.04
321-163	100	25	1 1/8"	"				Omitte.	Aircraft AMP 3155-23-100	0.04
321-162	125	25	1-9/16"	SD Slot.				Omitte.	Type N.	0.04
321-161	130	25	1-9/16"	7/16"				Omitte.	Type N.	0.04
321-160	135	25	1-9/16"	7/16"				Omitte.	Type N.	0.04
321-159	135	25	1-9/16"	7/16"				Omitte.	Type N.	0.04
321-158	140	25	1-7/8"	7/16"				Omitte.	Cockpit lock type.	0.04
321-157	145	25	1-7/8"	7/16"				Omitte.	Cockpit lock type.	0.04
321-156	150	25	1-9/16"	SD Slot.				Omitte.	Type N.	0.04
321-155	175	25	1-9/16"	7/16"				Omitte.	Type N.	0.04
321-154	175	25	1-9/16"	7/16"				Omitte.	Type N.	0.04
321-153	175	25	1-9/16"	7/16"				Omitte.	Type N.	0.04
321-152	175	25	1-9/16"	7/16"				Omitte.	Type N.	0.04
321-151	200	35	1-3/4"	7/16"				Omitte.	Type D.	0.04
321-141	320	35	1-9/16"	8/16"				Omitte.	Type D.	0.04
321-140	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-139	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-138	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-137	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-136	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-135	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-134	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-133	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-132	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-131	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-130	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-129	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-128	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-127	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-126	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-125	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-124	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-123	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-122	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-121	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-120	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-119	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-118	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-117	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-116	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-115	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-114	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-113	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-112	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-111	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-110	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-109	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-108	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-107	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-106	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-105	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-104	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-103	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-102	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-101	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-100	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-099	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-098	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-097	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-096	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-095	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-094	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-093	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-092	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-091	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-090	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-089	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-088	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-087	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-086	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-085	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-084	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-083	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-082	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-081	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-080	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-079	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-078	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-077	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-076	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-075	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-074	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-073	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-072	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-071	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-070	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-069	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-068	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-067	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-066	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-065	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-064	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-063	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-062	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-061	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-060	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-059	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-058	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-057	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-056	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-055	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-054	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-053	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-052	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-051	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-050	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-049	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-048	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-047	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-046	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-045	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-044	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-043	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-042	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-041	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-040	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-039	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-038	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-037	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-036	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-035	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-034	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-033	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-032	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-031	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-030	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-029	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-028	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-027	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-026	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-025	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-024	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-023	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-022	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.04
321-021	320	35	1-9/16"	7/16"				Omitte.	Type D.	0.0

WE ARE LISTING ABOVE OUR MOST POPULAR WIRE WOUND METER CONTROLS AND RHEOSTATS PRODUCED BY LEADING MANUFACTURERS SUCH AS OHMITE, WARD LEONARD, CLARSTAT, ETC. PLEASE WIRE OR WRITE FOR QUANTITY DISCOUNT.

## ADJUSTABLE WIRE WOUND RESISTORS

OWNS	PRICE	OWNS	PRICE
REG.	FACE	REG.	FACE
1. 50	200	1. 50	200
2. 75	100	2. 75	100
3. 10	100	3. 10	100
4. 100	200	4. 100	200
5. 10	200	5. 10	200
6. 10	200	6. 10	200
7. 10	200	7. 10	200
8. 10	200	8. 10	200
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89. 10	200	89. 10	200
90. 10	200	90. 10	200
91. 10	200	91. 10	200
92. 10	200	92. 10	200

# TUBES

*Guaranteed*  
by  
**WELLS**

**IMMEDIATE DELIVERY  
AT LOWEST PRICES IN**

<b>OUR HISTORY</b>		
01A	80-45	65
8-20-00	1-20-00	1-20-00

Check this list for exceptional values in magnetics, cathode ray tubes, voltage regulators, transmitting tubes—also neon, pilot and flashlight bulbs. These are brand new, standard sizes tubes. Order enough for future needs. **Ships from this ad or through your local parts dealer.**

00	127A	3.86	714AY	9.86	878	2.8
00	VR-157	9.86	8K715B	7.90	930	2.8
00	VT-158	9.86	717A	9.86	954	2.8
00	7C-159	29.86	800	9.86	955	2.8
00	205B	9.86	801	9.86	956	2.8
00	814	9.86	824B	9.86	957	2.8
00	21D	1.30	750A	19.86	961	NE-10
00	21E	4.25	750A	11.48	962	2.8
00	904TH	9.86	901	40	1201	2.8
00	904TL	1.75	901A	75	1616	2.8
00	904T	9.86	901B	849	1617	2.8
00	915B	4.75	904	9.86	1625	2.8
00	350A	2.85	905	8.86	1626	2.8
00	350B	75	906	77.75	820	2.8
00	350C	4.85	909	2.75	1628	2.8
00	350D	9.86	910	17.65	1630	2.8
00	434A	7.45	911	2.35	2051	2.8
00	446A	1.55	913	7.85	7100	2.8
00	4507A	2.15	914	2.45	9011	2.8
00	GL-471A	7.75	915	2.85	9012	2.8
00	725	11.75	916	5.00	9030	2.8
00	WL-300	17.50	920	3.25	9025	2.8
00	WL-331	17.50	920B	3.85	9031	2.8
00	3503-1383	9.86	902C	1.30	9032	2.8
00	GL-359	3.75	928	3.25	9033	2.8
00	HY-610	7.75	941	9.86	9004	2.8
00	205B	1.20	433	9.86	9006	2.8
00	205B	9.86	951	29.86		
00	205B	1.00	WL-800	22.50		
00	205B	9.86	961	22.50		
00	202A	2.50	964			
00	202A	2.50	965	2.50		
00	205A	2.50	966A	1.30		
00	205A	2.50	967	NE-20		
00	207B	23.25	970A	28.95		
00	210A	2.15	972A	2.45		
00	212A	2.75	973A	NE-21		

		NECH BUILDERS FOR RADIO USE	
00	202A	2.50	NE-15
00	202A	2.50	NE-16
00	205A	1.30	NE-17
00	205A	2.50	NE-18
00	207B	23.25	NE-21
00	210A	2.15	NE-21
00	212A	2.75	NE-21

## PILOT AND FLASHLIGHT BULB

Year	Model	Make	Year	Model	Make
1960	1960	1960	1960	1960	1960
1961	1961	1961	1961	1961	1961
1962	1962	1962	1962	1962	1962
1963	1963	1963	1963	1963	1963
1964	1964	1964	1964	1964	1964
1965	1965	1965	1965	1965	1965
1966	1966	1966	1966	1966	1966
1967	1967	1967	1967	1967	1967
1968	1968	1968	1968	1968	1968
1969	1969	1969	1969	1969	1969
1970	1970	1970	1970	1970	1970
1971	1971	1971	1971	1971	1971
1972	1972	1972	1972	1972	1972
1973	1973	1973	1973	1973	1973
1974	1974	1974	1974	1974	1974
1975	1975	1975	1975	1975	1975
1976	1976	1976	1976	1976	1976
1977	1977	1977	1977	1977	1977
1978	1978	1978	1978	1978	1978
1979	1979	1979	1979	1979	1979
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1981	1981	1981	1981	1981	1981
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1983	1983	1983	1983	1983	1983
1984	1984	1984	1984	1984	1984
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2011	2011	2011	2011	2011	2011
2012	2012	2012	2012	2012	2012
2013	2013	2013	2013	2013	2013
2014	2014	2014	2014	2014	2014
2015	2015	2015	2015	2015	2015
2016	2016	2016	2016	2016	2016
2017	2017	2017	2017	2017	2017
2018	2018	2018	2018	2018	2018
2019	2019	2019	2019	2019	2019
2020			2020		

**10% DISCOUNT ON ORDERS OF \$100.00 OR OVER**

**Manufacturers:** We carry thousands of electronic parts in stock.

Distributors: Our standard jobber arrangement applies. Order directly from this ad.

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